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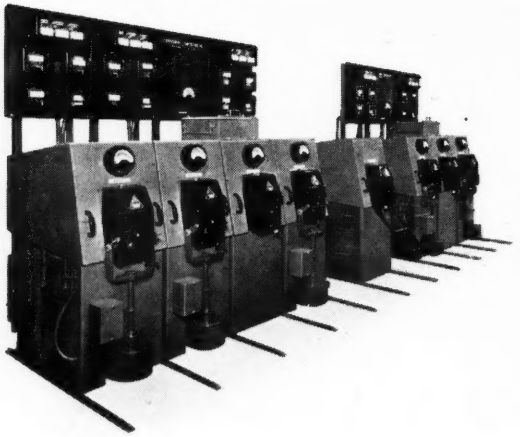

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ELECTRICAL REVIEW

December 8, 1944

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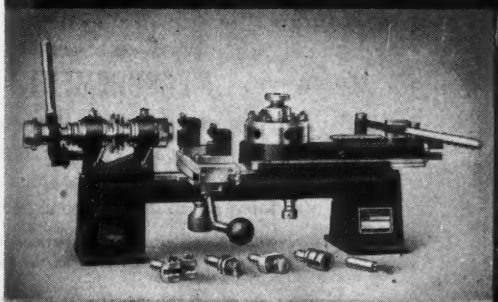

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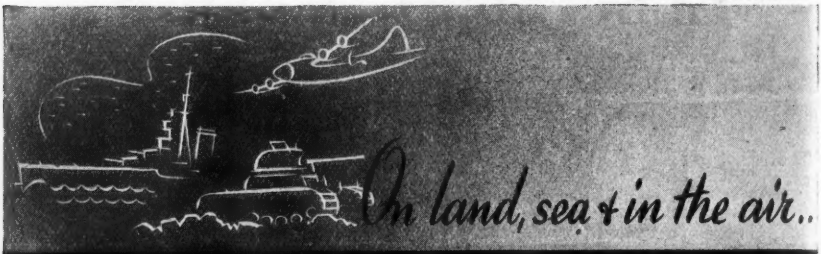

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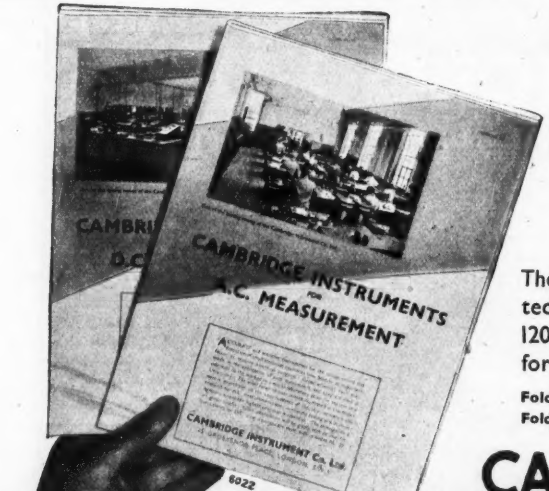

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ELECTRICAL REVIEW

THE OLDEST ELECTRICAL PAPER — ESTABLISHED 1872

Vol. CXXXV. No. 3498. DECEMBER 8, 1944 9d. WEEKLY

River Power

A Welsh "T.V.A." and the Severn Barrage

MUCH magic is thought to reside in such a phrase as "the Tennessee Valley Authority." It was heard during the preliminary discussions of the Scottish hydro-electric scheme and now it is common currency in Wales. A "T.V.A." has even been suggested for the North-East Coast. It is evident that many who murmur this incantation are not aware of its true nature. The Tennessee Valley scheme was not primarily a means of producing cheap electricity; it had its origin in the need to control the Mississippi whose unruly habits are familiar to readers of Mark Twain and other American authors. In conjunction with this the T.V.A. scheme was meant to improve navigation and to restore fertility to the overworked soil of the vast area involved.

Incidence of Capital Cost

To accomplish the last-named object cheap electricity for fertiliser production was essential and the obvious way of obtaining this was to utilise the power held up by the flood-control dams. This power was not only adequate for the purpose; there was an immense surplus for distribution to the population of the Tennessee Valley at very favourable rates. The way in which capital costs have been apportioned is not clear, but it seems that the bulk of the civil engineering work behind the generation of electricity is not being paid for by the electricity consumers, as it probably would have been for a straightforward hydro-electric undertaking.

Conditions in Wales are hardly comparable to those in the Tennessee Valley unless, of course, those who use the T.V.A. parallel have in mind a Severn Barrage as a possible background (and that would be half "English" anyway). A great deal of the talk of a "Welsh T.V.A." is purely nationalistic, but this cannot be said of a memorandum on the Severn Barrage by the South Wales and Monmouthshire Bulk Supply Association, which advocates the scheme as a means of maintaining *Britain's* industrial strength and conserving coal.

Elimination of Reservoir

The memorandum, which generally approves the 1933 Severn Barrage Committee's report (but seems to ignore the Donkin Committee whose report is now in the hands of the Minister of Fuel and Power), relates the barrage to a road and railway bridge and new harbour facilities the cost of which would be borne by the Exchequer. This would reduce the expenditure (including compound interest) chargeable to the scheme by about £12,000,000. A further £12,000,000 could be saved by the elimination of the reservoir and storage station proposed by the 1933 Committee; it is contended that the grid would be capable of absorbing the output from the barrage irrespective of the state of the tides. In this the Association may be anticipating to some extent the findings of the Donkin Committee. Here we may recall that Mr. Tom Smith said in the House of Commons three or four weeks ago that the Donkin Committee recommended that the proposals for a road and

rail bridge over the Severn should be considered separately. If the Donkin Committee considers that a Severn Barrage is desirable for the well-being of the country (not necessarily Wales alone) and can be constructed at a reasonable, though perhaps not strictly "economic" cost, it will be as well to get on with the work as soon as possible, for the most optimistic estimate puts the time for construction at six years.

Lend-Lease and Exports

LEND-LEASE arrangements with the United States involved an undertaking on Great Britain's part that none of the materials received, or similar materials, would be used for export purposes—apart, of course, from those exports necessary to the conduct of the war. This necessarily exercised a restrictive effect upon our export trade and in some directions prevented us from exporting even limited quantities of goods which would have served to maintain overseas trade links. Now an agreement has been reached which will remove at least a part of this obstacle. Any materials or equipment received from the United States which it is desired to use for export purposes will be paid for. The existing Lend-Lease system will be confined to the supply of goods for the manufacture of munitions and the maintenance of our essential wartime economy. Little more can be done until Germany is defeated but, as the Prime Minister said last week, exporters will now be able to make their plans for post-European-war trade with much more certainty.

Smaller Fluorescent Tubes

HITHERTO the only fluorescent lamp available in this country has been the 5-ft. 80-W tube. During the war, although it has still been obtainable, it has been necessary to secure a licence for the purpose. Recently in a rather quiet way a smaller size has been introduced and may be seen in experimental operation in one of the "Underground" coaches. It is a 2-ft. tube rated at 20 W and twenty-four of these used practically end-to-end, give excellent results. The London Passenger Transport Board hints that this is the sort of lighting which it proposes to install in the future. When the smaller size (or sizes) become generally available here, as they have been in the United States, there will be an immense demand for the new lamps from commercial concerns and from the general public.

Dr. Paterson's Views

SOME idea of the future of fluorescent lighting was given in an *Evening Standard* article last week by Dr. C. C. Paterson, director of the G.E.C. Research Laboratories, in which much of the work on the subject has been carried out. Dr. Paterson points out that the war has held up developments in this country. The United States was not handicapped in this way for two years and in consequence is producing 50 million fluorescent lamps this year. It is stressed that industrial and public premises will be the first to be lighted by the new lamps; before they can be applied to domestic lighting it will usually be necessary to re-design the lighting installation.

District Heating

A QUESTION in the House last week and our own Correspondence section indicate continuous interest in district heating. The subject was discussed in our leading article last week with reference to a new power and heating station which, with its plant constructed in Great Britain, was described in the same issue. Although the thermodynamic efficiency of this mixed station is appreciably in advance of that obtainable with conventional design, it is significant that no attempt is made to reach the very high values mentioned during the Parliamentary proceedings. The most important aspect of the question was probably the reply it elicited from the Minister of Fuel and Power to the effect that he regarded the pressing forward of the C.E.B. programme of generating extensions as a matter of urgency.

Heat Distribution

ACTUALLY the modifications necessary in the power station present a simpler problem than does the disposal of the "surplus" heat outside, which is probably engaging the greater share of the attention of the Sub-Committee of the Department of Scientific and Industrial Research. The economic scope of district heating may well be found to be restricted to a few special areas. In any event the need for cheap electricity for motive power and metallurgical processes should be the first consideration and the

provision of heat should be looked on as a by-product. In order to safeguard industry, not only should the cost of steam per kWh be no more than at present, but the benefits of the technical advances that would otherwise have been made should still be credited in full to the generation of electricity.

Export Prices

So many independent variables enter into the cost of manufactured goods, particularly those so specialised as electrical equipment and appliances, that there are great differences in the proportions by which prices have risen during the war. This is illustrated by the few instances in the export trade returns in which both quantities and values are given. Worked out on a pounds sterling per ton, or per article, basis the price of exported generators rose by 63 per cent. between 1938 and 1943; that of convertors and transformers (combined in the 1938 returns) 56 per cent.; switchgear 36 per cent.; and motors only 24 per cent. Among the smaller equipment, the price of house service meters increased by 47 per cent. and that of lamps by 33 per cent. The official statistics show an increase for all electrical goods and apparatus of 64 per cent. and for machinery (including electrical) of 68 per cent. The method is very rough and ready and takes no account of variations in the make-up of the totals, but it would seem that in spite of the greater costs of labour, material, transport and insurance the increases in prices of exported electrical machinery and equipment have been comparatively moderate.

Age Limits

MR. E. A. PINTO, in a letter published in our issue of December 1st, resurrects a matter which became very acute during the two wars but has necessarily remained quiescent with the wartime demand for man-power. It is the frequent stipulation that applicants for positions shall not be more than forty, or sometimes forty-five. There are several reasons for this requirement: Mr. Pinto thinks that one of the most potent is the difficulty of fitting elderly men into pension schemes. In municipal service this is surmounted by the interchangeability of the arrangements between authorities, but of course this does not provide for newcomers to the service. Such men must be prepared to make up a good deal of arrears if they are allowed to enter a pension scheme. The subject is one which will affect a good many returning men who have "grown old" in the service of the country since they joined up.

What Solution?

THERE are difficulties in the way of excluding men from pension schemes when they join a concern—public or private—at forty or thereabouts. No self-respecting firm wants to retire men without some form of provision for their retirement and it is consequently reluctant to engage them in the first place, even if they agree that they cannot participate in the firm's pension arrangements. It does not seem as though the Canadian suggestion, mentioned by Mr. Pinto, that it should be made an offence to refuse employment on account of age is practical politics. The only solution (and that not an immediate one) seems to be the establishment of a general scheme of pensions for professional men to which they and their employers would contribute from the beginning of their careers. This would almost inevitably be a matter for the State but there seems to be little chance of such sectional social legislation getting through.

Electricity in Mines

IN addition to the ordinary electrical hazards of shocks and burns found in industry generally, there are especial risks in collieries. Of the thirteen fatalities, above and below ground, last year, three were caused by ignition of fire-damp and three by explosion of detonators. Sixty-one persons received non-fatal injuries, twelve owing to fire-damp ignition and three to the bursting of apparatus; even shocks and burns were of an unusual kind, no fewer than ten having been caused by damage to trailing cables by shot-firing. Altogether six fatal and twenty-nine non-fatal accidents were associated with trailing cables and plugs. Mr. G. M. Harvey, Senior Electrical Inspector of Mines, who gives the above figures in the *Mining Electrical and Mechanical Engineer*, regards them as evidence of the ill-treatment commonly meted out to trailing cables. And yet complaints are sometimes made of the heaviness of modern cables designed to mitigate these effects.

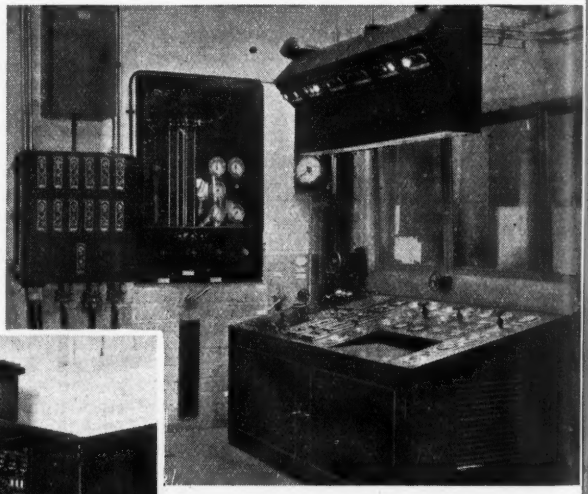
Aero-Engine Testing

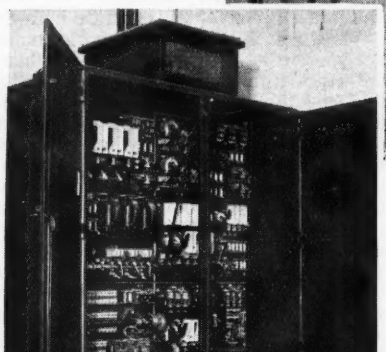
A New Test-Bed Installation

A MOST important factor in the establishment of four new aero-engine testing beds in a large Rolls-Royce factory lies in an attempt to line up with the Emergency Powers Statutory Rules and Orders, dealing with fire prevention measures in aero-engine testing equipment. Since it would be too expensive to make the whole job flameproof, the aim has been to make flameproof only that equipment in each bed which is likely to be in use when the engine is not on test. This includes the general lighting, roller doors, various switch-plugs on the beds, and pilot lamps which indicate A.R.P. messages. All the other equipment on the bed is not flameproof, but it cannot be made alive until the extract ventilation in the bed and in the petrol cubicle has been in operation for half a minute, so as to allow for the scavenging of any petrol which may have been present in the test-bed room.

All petrol-handling equipment has been segregated from the main control room for each bed, and is housed in a small flameproof cubicle adjacent to the control room. The cubicle has a window through which the petrol flowmeter, and pressure and boost gauges in the cubicle can be viewed by the operator standing at the control desk. In this way, the electrical equipment in the control room is exempted from being flameproof.

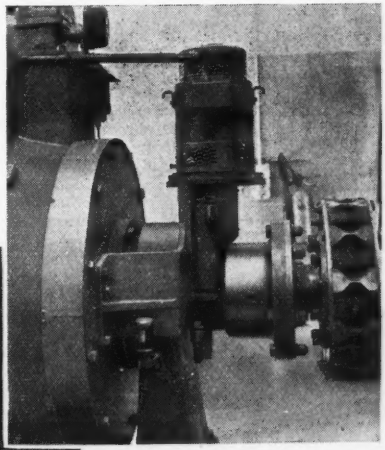
A solenoid-operated valve inside the petrol cubicle prevents petrol from being fed to the test bed until the ventilation of both the test bed and the cubicle is under way. As a precaution against fire originating in the petrol cubicle, carbon-dioxide fire-fighting equipment is provided and can be brought into operation by means of a heat fusible link. This link, in turn, isolates the cubicle ventilation and operates a pressure limit switch which both closes the solenoid valve and shuts down the petrol pumps supplying all the beds. To protect the engine against various factors depending on the human element, limit switches are provided on the valves of the



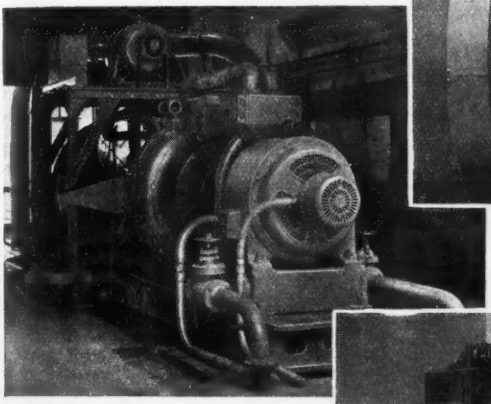


Control desk next to cubicle window; note illumination canopy with indicating lamps, and, to the left, push-button control station for petrol pump, cooling-water pump and water cooler fan motors
At the far end of the line of control equipment in each section of the control room are the main cubicle-housed contactor and control-equipment panels (left-hand picture). The m.g. set for the dynamatic dynamometer excitation and the engine-starting battery are seen at the bottom

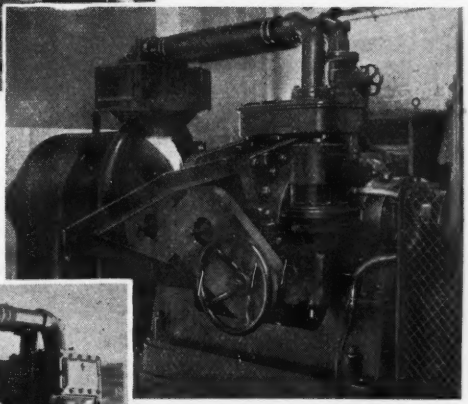
engine-coolant system and the main oil line to the engine pump. Further protection against lack of water in the dynamometer, excess temperature of the dynamometer cooling water, and overspeeding of the engine is provided by a water pressure switch, a thermostat and an overspeed relay, respectively. All these items are arranged to operate relays which will earth the engine ignition system in the event of the emergency equipment being brought into operation.

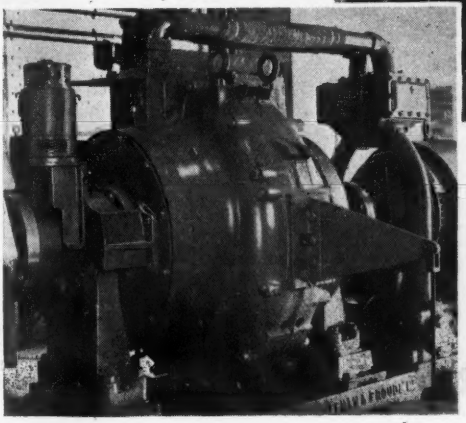


Excitation of the dynamatic dynamometer is effected by a variable-speed exciter driven by gearing off the main shaft; note thermostat and pressure switch



Main engine-starting motor (front) and engine-cooling fan motor surmounting the test-bed superstructure

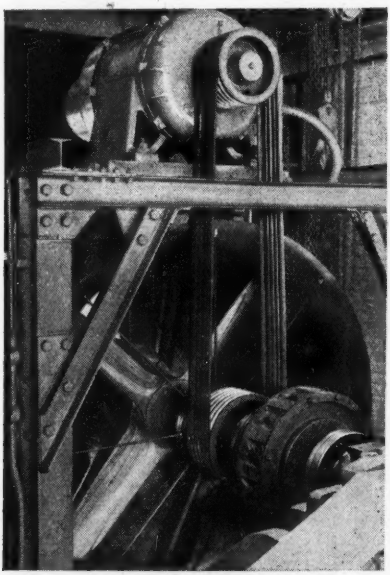




Load on the hydraulic dynamometer is controlled by means of a sluice valve which can be operated manually or by a geared motor seen to the right. The dynamatic dynamometer (left) is not regenerative, and it dissipates its energy as heat which is conducted away by the cooling water

The building which houses the new installation is so laid out that each control room serves two test beds, one on either side of the control room, with all the beds and control rooms in one line. Separate from the main building are a petrol-pump room and a water-pump house with a water-cooling system, all common to the four test beds. Each test bed consists of an engine mounting upon which the engine is rigged, served by various supply pipes and

electrical connections. When the engine is in position, the airscrew shaft is coupled to a transmission shaft connected to the dynamometer. Between the engine and the dynamometer a cooling fan is mounted in such a way that it runs co-axially with the transmission shaft, but is free to run independently of this shaft. At the farther end of the dynamometer is a 120-HP motor which can be coupled to the dynamometer shaft by means of a dog clutch for engine starting. An extract fan is mounted on the roof trusses at the engine end of the bed, and draws air through a ducting system from a point just below the rear of the engine. Two intake fans,



Between the engine and the dynamometer is a fan which runs co-axially with the transmission shaft, but is free to operate independently of this shaft

fitted into the wall at the other end of the bed, are equipped with heaters to warm the incoming air in cold weather.

There are two entirely separate but identical sets of equipment in each control room, each set serving its own test bed. At the engine end of each set of control equipment is the petrol cubicle, next to which is the control desk, followed by the dynamometer weighing gear, and finally, at the other end of the line, are the electrical control panels.

There is an intake fan at each end of the control room, and this draws its air over a heating battery. The extract air is provided for by Robertson ventilation equipment arranged in the centre of the control-room roof. Practically all starting and testing operations can be effected from the control desk. Push-buttons controlling all the motors on the test beds are suitably mounted on the desk, and a canopy containing "Mazda" fluorescent lighting fittings which provide the control desk illumination also accommodates a number of indicating lamps in a multi-way indicator which permits the operator to see, at a glance, the state of every drive, or what it is necessary to do if, say, the main engine-starting motor will not start up.

Another section of the desk is devoted to the dynamatic dynamometer controls. All these controls are mounted adjacent to the engine throttle, supercharger change speed, and slow running cut-out levers on the control desk within easy reach of the operator. Various pressure gauges, thermometers and cooling-water control valves are also mounted on the desk, while the petrol gauges are in the petrol cubicle and are observed through the window, as we have already indicated. The engine tachometer is mounted on the wall behind the desk, next to the depression telegauge and close to the boost gauge in the cubicle, so that all three gauges may be easily observed by the operator. Near the petrol cubicle window is a push-button station for the six ½-HP petrol-pump motors, with direct-on starting, the three 27-HP water-cooler fan motors and the three 35-HP water-pump motors, with star-delta starting. The starters for these twelve motors are located in the pump house.

Testing Procedure

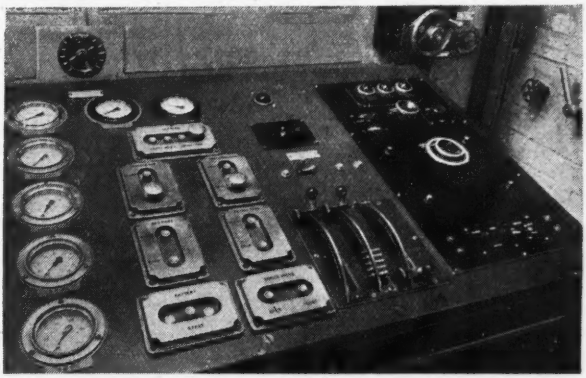
Let us attempt to describe the operations of an actual test, assuming, of course, that the engine is mounted, rigged and coupled to the transmission shaft. The main isolator on the main control panel is first switched on, and this operation is indicated by the appropriate pilot lamp over the control desk. Then the ventilation motors are started up by means of one push-button for the petrol cubicle ventilation, and one push-button for the test-bed ventilation. These operations are also indicated by the appropriate pilot lamps. At the same time the petrol pump, the water pump and the water-cooler fan motors are all started up, and the starting up of the water pump automatically operates a pressure switch which serves the appropriate indicating pilot lamp.

After a delay of half a minute "plant ready" is indicated by the appropriate pilot lamp, whereupon the Glycol (coolant) inlet valve, the Glycol outlet valve and the main oil valve are all opened, and these operations are indicated by the pilot lights. These valves are so interlocked that the engine cannot be started until they are opened.

The next operations are to engage the dog-clutch from the 120-HP engine-starting motor,

start up the motor-generator set which provides excitation for the dynamatic dynamometer, start up the engine-cooling fan and then to run up the main engine motor. This motor is accelerated until the correct starting speed is reached. The main engine-starting motor is controlled by "start," "stop," "accelerate," and "retard" push-buttons. The accelerate and retard push-buttons control a reversing geared pilot motor on the control panel which drives a rotor regulator to vary the speed of the main motor, according to testing requirements. Whenever the main motor is stopped, the rotor regulator is returned automatically to the low-speed position, and the main motor cannot be started until the low-speed position is reached.

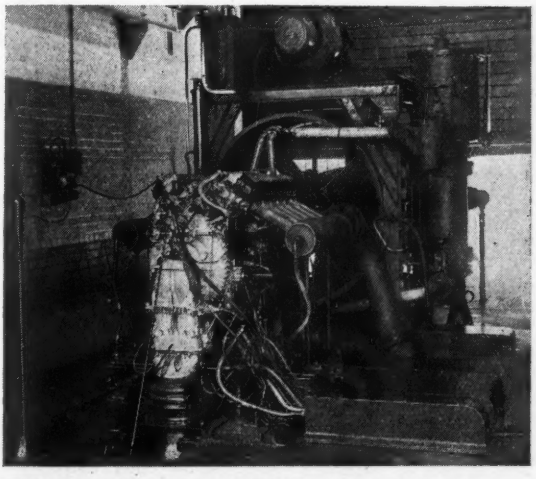
The magneto earthing switches are next turned to the "on" position. In order to make the engine fire an "ignition" push-button is pressed so as to actuate the earthing relays in the control cubicle. At this stage the engine is running under its own power, and when its speed exceeds that of the starting motor the dog-clutch is automatically disengaged, and this operation actuates a limit switch which shuts down the main motor. Load can now be applied to the engine by operating the dynamometer regulators.



Practically all the test-bed operations are effected from the control desk top; left, push-button controls for sluice valve, battery, starter, bed fans, petrol fan, motor-generator and main motor; centre, engine controls; right, dynamometer controls

Provision is made for the use of both the dynamatic and the hydraulic types of dynamometer; indeed, both types are being employed at this early stage in the operation of the new installation, and base-plate accommodation is provided for either type of dynamometer at each test bed. The propeller law characteristic is inherent to the water brake and the load is controlled by means of a sluice valve which can be operated either manually or by means of a geared motor with transmission *via* a lead screw. The travel of this screw in both directions is curtailed by limit switches, and the motor is controlled from the desk by forward and reverse push-buttons which actuate suitable contactors.

The dynamatic dynamometer is the type chosen for the new installation because there are no wearing parts other than the bearings. It is not regenerative, but it dissipates its energy as heat which is conducted away by the cooling water. The cast-steel stator is mounted on trunnions, and the torque reaction is transmitted through a system of levers linking up with the weighing gear in the control room. The stator is magnetised by a coil located centrally in a



Each test bed consists of an engine mounting upon which the engine is rigged, served by various supply pipes and electrical connections

duct right round the stator; consequently, in principle, the dynamometer is a homopolar unit.

The rotor is a solid steel casting, with teeth milled at the periphery. Hence, as the rotor revolves the magnetic concentrations at the teeth move round the stator wall, with the result that eddy currents are induced in the wall. These eddy currents give rise to heat which is dispersed in the cooling water which circulates round the stator. In order to create a propeller law characteristic the torque must be arranged to be proportional to the 1·8 power of the speed.

Since this characteristic is not inherent to this type of dynamometer the method of excitation used is that which will give the necessary torque as the speed rises. This is accomplished by means of a variable-speed exciter which is gear driven from the dynamometer shaft. The voltage of this exciter can be made proportional to the 1·8 power of the speed, and, in fact, this output can be varied by means of a pre-set regulator to give a response which is either higher or lower than this figure.

The actual excitation of the coil is provided by a motor-generator set whose field is controlled by the variable-speed exciter; thus the coil excitation is proportional to the output of the exciter.

As the torque absorbed by the dynamometer throughout most of its speed range is approximately proportional to the excitation, it follows that the desired characteristic can be obtained. The m.g. set carries a further exciter, the purpose of which is to supply the field of the variable-speed exciter. But the fixed-speed exciter also has other duties such as providing reverse excitation on the main generator in order to neutralise the residual magnetism in the dynamometer carcase. Hand control is used for the purpose of selecting a speed-torque characteristic suitable for the engine output, bearing in mind that the index remains the same for any selected characteristic.

Both the dynamatic and hydraulic types of dynamometer and water coolers with their associated electrical equipment are products of Heenan & Froude, Ltd. All other electrical control equipment was supplied by the Igranic Electric Company.

The motors used throughout the test beds were supplied by Brook Motors, Ltd., with the exception of the six flameproof petrol-pump motors, which are of Crompton Parkinson construction.

Rolls-Royce were responsible for the layout and installation of the beds, control rooms, pump houses and associated equipment, and constructed such items as the control desks, indicating lamp canopies and various electrical connection boards.

District Heating

Major Lloyd George's Statement

IN the House of Commons on November 28th, Mr. Bossom asked the Minister of Fuel and Power what proportion of the thermal units generated in our larger power stations was converted into electricity and what percentage would be available, if appropriate machinery were installed, for providing circulating district heating and circulating district hot water. Would the new electricity generating stations to be erected under the auspices of the Central Electricity Board be equipped so as to use their surplus heat after the generation of electricity for the purpose of providing circulating district heating and circulating district hot water in the areas in which they were constructed?

Major Lloyd George replied that district heating was at present being considered by a Sub-Committee of the Heating and Ventilation (Reconstruction) Committee appointed by the Department of Scientific and Industrial Research. The Government would wish to see the report of that Committee before it could formulate any policy on this matter. The development programme of generating stations just published was so urgent that it could not await the formulation of a policy on district heating which would require legislation. The proportion of heat units in the electricity sent out from the larger and more modern generating stations as compared with the heating units in the coal used ranged from 25 to 28 per cent. If certain difficulties were overcome and district heating from generating stations adopted, it might be possible to have made available 70 to 75 per cent. of the heat units in the coal for combined electrical and district heating purposes. The quantity of electricity, however, produced from every lb. of coal would be considerably less than with present methods and a proportionate increase in generating plant would be required to produce as much electricity.

Mr. Bossom asked the Minister if he considered it desirable that we should go on generating electricity in this unscientific manner when our national supplies of coal were diminishing.

Major Lloyd George agreed that we must utilise coal to the best possible advantage. While a certain amount of heat could be obtained from thermal units a considerable portion of electricity would be lost. It might be that future generating stations would have to be proportionately bigger to meet the demand for district heating.

Mr. A. Hopkinson: Is it not a fact that modern methods of electrical generation use up almost the theoretical amount of heat?

Mr. Bossom: Will the report of the Committee be out in time for the big housing development after the war?

Major Lloyd George: I have no doubt that it will be out before that time but with the extremely severe strain upon electricity at present we cannot wait for the report before putting up new stations.

Improved Installations

Discussion of I.E.E. Committees' Reports

AT last week's meeting of the Installations Section of the Institution of Electrical Engineers a discussion took place on (*a*) Section B (installation only) of the report on "Electricity Supply, Distribution and Installation" prepared by Sub-Committee No. 3 of the I.E.E. Post-War Planning Committee; and (*b*) the report of the Electrical Installations Committee convened by the Institution on behalf of the Ministry of Works: "Post-War Building Studies, No. 11: Electrical Installations." The chair was taken by MR. FORBES-JACKSON and the discussion was opened by MR. W. N. C. CLINCH who reviewed both reports. At the close of the discussion, MR. J. R. BEARD, chairman of the Committees responsible for the two reports, replied briefly to the various points that had been raised. A considerable number of speakers took part in the discussion.

The greatest attention was concentrated on plugs and sockets. Some objection was raised to the proposed 3-kW (230-V) socket-outlet and fused plug, one view being that at the present time there were some 10,000 pieces of apparatus requiring a 1-kW plug or less against one which required the larger size.

The idea of a single standard plug was strongly supported, but the size chosen was regarded with some doubt. Interchangeability of plugs and sockets was urged, but the view of one speaker was that B.S. 546, with its three sizes, rendered this impossible. It was asked whether one of these three sizes could not be adopted to avoid duplication as it was clear that the existing range of B.S.546 plugs would remain in being for many years.

Replacement or Revision of Rules

Views were expressed for and against the recommendation that the I.E.E. Wiring Regulations should be replaced by Basic Safety Regulations and Codes of Practice. A supply engineer welcomed the proposed change, pointing out that strict adherence to the Regulations would have precluded the use of ring or room circuits in certain experimental houses with which he had been concerned. On the other hand, some speakers deprecated the idea of superseding the I.E.E. Regulations, and made suggestions as to how they might be revised.

It was felt that the claim in Report No. 11 that a saving of approximately 25 per cent. might be achieved by a ring circuit in a given case might be misleading. This statement should not be construed as meaning that the more adequate provisions recommended for post-war housing would be obtained at a 25 per cent. reduction on pre-war costs, but that the improved facilities would be obtained at a cost proportionately less than with pre-war wiring methods.

One speaker said that by doing away with the ring circuit the greater part of local fusing would be also done away with. It was agreed, however, that local fusing might be necessary for certain apparatus. It was urged that the fuse should be in the socket where it was out of the way rather than in the plug.

Incidentally, the suggestion was made that fuses should be rated in watts as soon as a national standard voltage was established. An architect expressed appreciation on behalf of his profession of the work done by the Institution for so many years through the Wiring Rules. He also mentioned with approval the extensive use in America of circuit-breakers instead of fuses.

Fires and Refrigerators

It was suggested that socket outlets should not be in the skirting but at hand level. Another suggestion was that instead of one 3-kW fire at one end of a room with the occupants grouped round it, there should be more than one fire in different positions. The proposed 4 cu. ft. capacity for refrigerators was thought to be too big for some small houses. A capacity of 2 cu. ft. was considered by this speaker to be more suitable in these circumstances.

An all-insulated system was advocated, thus eliminating the use of conduit, although it was admitted it might not be possible to achieve this immediately and that the question of interference with radio reception would need to be borne in mind. The aim of the Study Committee in securing a neat, well-housed and unobtrusive design of consumers' supply control unit was applauded.

With regard to electricity in farm buildings, the lack of legal obligation on the part of the landlord to compensate the departing tenant for the improvement of farm property was regarded as more important now than the question of wayleaves. Mr. Beard, in replying to this point later, said the question was what could be done. The electrical case was merely part of a larger and most controversial matter, hence it might be difficult to secure legislation with regard to it.

Representatives of all sections of the industry concerned with installation work took part in the discussion, and the constructive comments made will receive further consideration by the Committees.

Mr. J. R. Beard in some concluding remarks, as chairman of the Committees,

said that the reports indicated general matters which it was thought should be discussed and which, after discussion, would lead to action. He did not think the question of the availability of two-part tariffs should affect consideration of control arrangements. although uniformity in form of tariffs was sincerely to be hoped for. The "No. 3 Committee" in dealing with this matter in its report had put forward what he hoped were useful suggestions.

Concerning the comments on the suggested 25 per cent. reduction on pre-war cost if ring circuits were used, he said this was intended to be an over-all figure and was based on a complete installation arranged to provide given facilities. Since the report was issued, arrangements had been made with six different parties representing contractors, supply authorities, etc., to prepare comparative estimates for certain typical houses of the class intended to be built after the war, using (*a*) ring circuits, (*b*) room circuits and (*c*) pre-war practices, and the figure mentioned in the Report had been fully confirmed.

The various arguments, put forward with regard to plugs and sockets had all been carefully weighed by the Committee but it was necessary to subordinate individual views to the choice of what was most likely to meet needs of users, and it was hoped there would be some common action on this important question as the result of what had been said during the discussion.

Impedance Measurement

Propagation Constants of R.F. Cables

THE measurement of balanced and unbalanced impedances at frequencies of the order of 500 Mc/s as a means of determining the propagation constants of radio-frequency communication cables is dealt with in a paper presented by DR. L. ESSEN (Radio Department, N.P.L.) before the Radio Section of the Institution of Electrical Engineers.

The investigations described formed part of the programme of the Radio Research Board, which received confidential reports on the subject in 1941-42. Although the general features of the electrical resonance of transmission lines had already been utilised for ascertaining impedance, no tuned-line apparatus suitable for routine measurements at the frequency mentioned had previously been developed. The author's work was an attempt to fulfil an urgent requirement for such apparatus, which was put into operation at once without its potential capabilities being thoroughly explored.

He employed an air-spaced concentric line for unbalanced and a screened twin line for balanced impedances, the length in each case being variable by means of a movable bridge carrying a thermo-junction. The component to be measured is connected to the open end of the line, which is then adjusted to current resonance by movement of the bridge, enabling the impedance to be evaluated from the readings of resonant length and the width of the resonant curve according to the Chipman principle. Only the bare outline of that form of computation is given, but convenient working equations are developed and results are quoted to check the validity of the assumptions which are involved.

The number of methods of making these measurements which are described have been designed to eliminate experimental errors, which are discussed in some detail in an appendix to the paper, the accuracies achieved being $\pm$ 2 per cent. and $\pm$ 5 per cent. respectively for a wide range of values of reactance and resistance.

Empire Broadcasting

Director-General's Forecast

IN the course of an address on post-war broadcasting at the monthly luncheon in London last week of the Radio Industries Club, Mr. W. J. Haley (Director-General, B.B.C.) declared his personal opinion to be that a sensibly modified system of world broadcasting should go on.

In the immediate post-war years the B.B.C. would have no more urgent task than that of stimulating broadcasting within and about the Commonwealth, to foster which the B.B.C. was anxious to do all it could in giving of its experience and help. Invitations issued by the B.B.C. to a conference to be held in London in February, 1945, had been accepted by the heads of all the Dominion organisations (Mr. Frigon, Canadian Corporation; Mr. Moses, Australian Commission; Mr. Shelley, New Zealand Company; and Mr. Bokhari, All-India Radio). From that meeting it was hoped that great benefits would accrue to all listeners at home and throughout the Commonwealth. One of the things the B.B.C. was keenest to develop was interchange with Dominion organisations, not merely the exchange of programmes but also of personnel.

Only the most careful management of wavelengths made ordinary listening possible and to cover even so small an area as the United Kingdom involved the use of many transmitters. It was necessary to emphasise that fact because there was extraordinary ignorance about that aspect of the subject. Only by the most careful and highly co-ordinated planning would the B.B.C. ever be able to ensure good listening to each and every villager and city dweller in this country, let alone a choice of services. Only by utilising every wavelength it could reasonably expect to have at its disposal and by employing every one of the large number of transmitters it possessed, would the B.B.C. be able to evolve a plan. As it was, the Corporation expected in due course after the war to have to introduce frequency modulation as a means of improving national coverage.

Thermostatic Control

Some Simple Forms

By T. Thorne Baker, F.Inst.P., A.M.I.E.E.

NOWADAYS thermostatic control is utilised largely for all sorts of purposes. Countless industrial chemical operations are carried out within a degree or so of a critical temperature by their use, while in the laboratory and workshop one is frequently confronted with the problem of maintaining a given temperature, often of comparatively small apparatus, when any large outlay would be prohibitive for the purpose concerned. In such cases the type of thermostat that depends on the high co-efficient of expansion

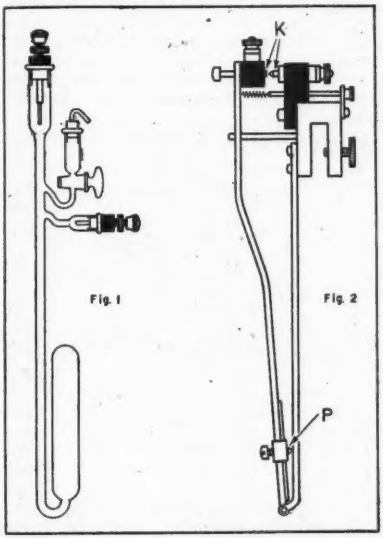


Fig. 1.—Toluene expansion thermostat (Griffin and Tatlock, Ltd.). Fig. 2.—Wide-range thermostat (C. Hearson and Co., Ltd.)

of liquid toluene is very handy; it is accurate, simple, and inexpensive.

One of these (Fig. 1) made by Griffin and Tatlock, Ltd., is a vertical cylindrical bulb about 6 in. high by 1 in. wide which tails off at the bottom in U-form to a capillary side arm. The bulb is filled with toluene (methylbenzene) which also runs about two-thirds the way up the capillary tube; on top of the toluene is a thread of mercury. A contact with adjusting screw is provided at the top of the thermostat and a second one at the side; just above the latter is a small cup and stopcock, mercury from the cup being flowed into the capillary tube as required for coarse adjustment.

The thermostat is very readily tuned up so that at, say, 50 deg. C. the toluene has expanded sufficiently to push the mercury upwards so far that it just touches the top contact, thus closing the circuit to the ends of which the top and side terminals are connected. With careful adjustment these thermostats will operate for months without attention within $\pm$ 0·5 deg. C. The thermostat is usually placed in series with one or two dry cells and a relay which operates the make-and-break device.

The Hearson Capsule

Although the Hearson capsule was originally invented to control the heat of an oil lamp for egg incubators, it works admirably as a delicate and highly reliable regulator of any form of electrical heating. I have had many years of experience of it in connection with the thermostatically controlled digesting baths used in the making of sensitised photographic products. The capsule itself is a small hermetically sealed envelope of copper filled with a liquid having a high co-efficient of expansion. It is fixed

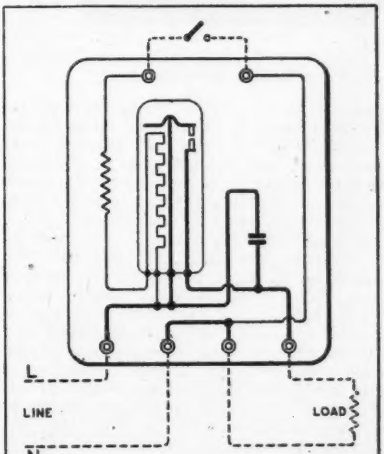


Fig. 3.—Controlling relay circuit

in the liquid or oven to be controlled. In the electrical form it forces a pin P (Fig. 2) outwards by expansion and, when above the

pre-set temperature, a simple lever opens or closes the contacts K K which, in turn, control the relay circuit, as indicated in the

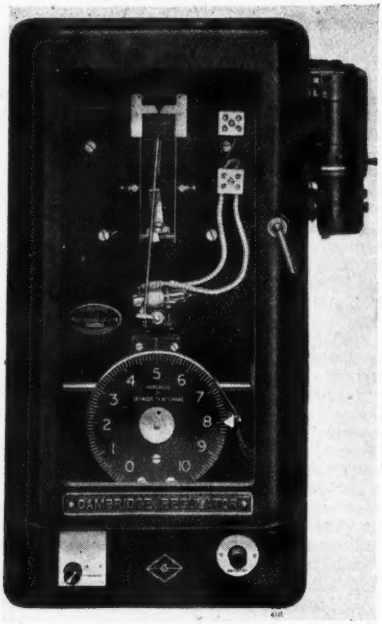


Fig. 4.—Precision temperature regulator (Cambridge Instrument Co., Ltd.)

diagram Fig. 3. A small pilot lamp indicates when the heater is functioning. This system is excellent for hot water baths between room temperature and about 80 deg. C. A somewhat modified type is supplied for maintaining low temperatures between 10 and 22 deg. C. for bacteriological incubators, etc.

A wide-range thermostat is also made by C. Hearson and Co., Ltd., in which the capsule is replaced by a thick plicated band of brass, faced in places with "Isidur" steel. The brass has a high co-efficient of expansion, the steel a negligible one. The brass and steel are so arranged that on expansion of the brass it recedes from the steel, acting on a lever which puts the platinum electrodes out of contact. This type will control a range of temperatures from 100 to 300 deg. C., working equally on AC or DC.

A high accuracy is obtainable, such as ± 0·1 per cent. over a range of 1,000 deg. C., with the Cambridge controller, which operates normally on a potentiometer principle, but if used with electrical resistance thermometers it operates as a Wheatstone bridge. Iron-constantan, titan and platinum-rhodium thermocouples may be used, according to the range of temperature; a galvanometer is the sensitive detecting instrument and the balanced or null position of the pointer is established by means of a rheostat to correspond with the desired control temperature. Mercury switches are used to make and break the circuit, the whole instrument being enclosed in dustproof metal casing for flush or panel mounting.

New Controlled Oven

A new corrosion-proof electrically heated oven thermostatically controlled within ± 2 deg. C. at a temperature of 300 deg. C. is made by Griffin and Tatlock, Ltd. Asbestos-cement walls are lined with aluminium. Gravity convection is utilised in heating. A new type of thermostat with spring loaded contacts actuates a universal AC-DC relay with mercury switch make-and-break. The range of this laboratory oven is from 20 to 300 deg. C. The internal dimensions are 12 by 12 by 12 in. and the external dimensions 20 by 17 by 17 in. It is known as the "Microid Temperostat."

Another instance of applied thermostatic

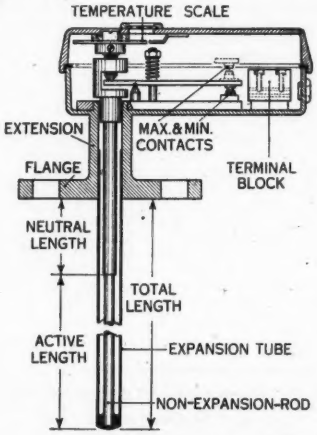


Fig. 5.—Room air thermostat (British Arca Regulators, Ltd.)

control is the thermal protective device for single-phase capacitor fractional horse-power motors, a B.T.H. device which affords automatic protection against injurious overloads. The motor is automatically switched off before it becomes overheated, and is restored to service when the machine has cooled sufficiently. A bi-metallic helix is assembled in close association with a heater helix connected in series with the motor windings. At a predetermined temperature the bi-metal helix twists and opens a pair of

silver-to-silver contacts which are normally closed.

Another motor protective thermostat, which is also being utilised for medical appliances, is made by Salford Electrical Instruments, Ltd. It is a small disc supported at the centre and concave when cool, changing with a swap action to convex shape when heated, so that appreciable current can be broken around the disc edge at normal voltages.

A simple form of control for laboratory electric furnaces, such as the combustion type, has been recently devised by Hurst and Cannon (J. Sci. Inst., Aug., 1943). A potentiometer bridge and a photo-cell relay are employed. A chrome-alumel thermocouple is used, the EMF of which is opposed by a standard EMF from a potentiometer. The differential EMF deflects a taut-suspension mirror galvanometer, which reflects a beam of light on to a commercial photo-cell relay (G.E.C. Type B 4). Several furnaces can be controlled simultaneously by the same photo-cell unit.

Precision Thermostat Bath

A toluol-mercury regulator is used in an interesting type of low temperature thermostat bath recently introduced by Townson and Mercer, Ltd. Its overall dimensions are 20 by 12 by 8 in., with a clear working space of 16 by 12 by 6 in. deep; 5·4 gal. water is thus required to fill the bath. A heating element and a cooling element are placed in a high-velocity stream of water which is pumped through the bath at about 80 gal. per hour through a fan-shaped opening facing one side of the bath. As an example of performance, it is stated that if the cooler be fed with water from the mains at 18 deg. C. the bath would stabilise at 22 deg. C. with a normal variation of ± 0·04 deg.; without the cooler element the bath would stabilise at about 30 deg. C.

Precision thermostats for temperatures up to 850 deg. C. are made also by British Arca Regulations, Ltd. They are constructed both to open and to close an electric circuit when the temperature rises above or falls below given values and to control a given temperature difference between, say, the incoming air and the interior of a workshop or building. The thermostat consists essentially of a head carrying an extension rod or "feeler" of suitable length which is exposed to the temperature to be controlled. The feeler (Fig. 5), has a negligible co-efficient of expansion, and is surrounded by a tube of the second material with the usual high co-efficient of expansion. As the temperature rises the difference between the expansions of tube and rod operates a lever mechanism contained in the head which, in turn, actuates palladium-copper alloy contacts. The dimensions of the head are 5¼ by 2¼ by 1¾ in., the length of the feeler being arranged to suit the job. A special mercury relay has been developed for use with thermostats with loads above 10 A, AC.

It is thus evident that automatic regulation of temperature can be achieved by the use of the differential expansion of two metals having widely different co-efficients of expansion (or by the expansion of a liquid or vapour) and electrically by the use of some form of galvanometer and relay operated by a thermocouple. Contact patterns of the latter are made by the Cambridge Instrument Co. for controlling the temperature of heated rollers, etc. To the electric type must be added resistance thermometers consisting essentially of a metal dome, the inner surface of which is wound with silk covered platinum wire, a large surface being thus offered. For controlling temperatures up to and around the boiling point these are very sensitive; watertight patterns are also made for cold storage.

Chile's Imports

Marked Reduction Last Year

IN the electrical import trade of Chile in 1943, for which summary figures have recently been released, there was a marked decline on 1942, relieved only by a small increase in the power plant group. The only branch in which mention is made of supplying countries is lamps. There the falling off was nearly all in imports from Argentina.

The statistics available for 1943 are shown below, with notes of increase or decrease compared with 1942 (Peso = 6d.).

The recently published account of the 1943 operations of the official Development Corporation of Chile, which covers practically every type of industry, refers to the electrification programme. It says that the Pilmaiquen and Sauzal stations made further progress, and work was begun on the Abanico central station which is expected to furnish power to all the zone of which Concepcion is the centre. The transmission line from Ovalle to Punitaqui is expected to be in service very shortly. The extension of the Tocopilla, Copiapo, and Ovalle electric services continued, with the number of new customers surpassing the most optimistic expectations. The Corporation extended loans for increasing domestic production of electrical articles.

Class of Goods	1943 Pesos (000)	Inc. or dec. on 1942 Pesos (000)
Dynamos, alternators, etc. ..	1,440	+ 140
Electric motors	1,260	— 240
Parts and accessories for motors	1,860	— 340
Cables and flex	3,740	— 660
Meters and parts	370	— 180
Telegraph and telephone apparatus	125	— 605
Radio receivers and transmitters	1,440	— 3,060
Radio valves	480	— 220
Lamps, incandescent, for lighting and heating	1,360	— 240
From Argentina	25	— 205
„ United States	1,304	— 16

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for correspondents' opinions.

District Heating

TO argue that because our climatic conditions are not rigorous therefore district heating is unjustified does not bear investigation. To say that the process whereby heat is rejected from a heat engine is reversed in the electric radiator is untrue.

District heating is a means of utilising the latent heat of steam after it has done mechanical work in a heat engine and as such is thermally justified in any event. Whether it is economically justified is another matter, but in my opinion the subject requires more than the cursory investigation it is getting, and the potential demand is greater than is commonly supposed.

The efficiency of a heat-electric station in terms of power is, of course, not raised by distributing the rejected heat, but as a national process in which at least 50 per cent. of the heat of the fuel (won at so great a cost and sold at a greater) is now rejected to the nearest river or the surrounding air indiscriminately, the efficiency of use of fuel is raised by the distribution of the rejected heat in a way which makes provision of that heat by other means unnecessary.

B. S. GYLES, B.Sc.(Eng.), A.M.I.Mech.E.
Clearwell, nr. Coleford, Glos.

IN the correspondence columns of your issue of November 24th, Mr. B. Lloyd Price lucidly analyses the thermodynamics of district heating but in the last paragraph detracts from the value of his letter by drawing a wholly unjustified conclusion.

Stating that what district heaters are after is rejected heat (true in the sense that rejected heat is economical heat, and hence to be preferred), he concludes with the remark that "we may have the paradox of finding that our most efficient station is that in which power production has been squeezed out altogether."

That surely is incorrect. From what source other than loaded pass-out or back pressure turbines could rejected heat be obtained? Rejected heat is necessarily a by-product of power production, and there is no possibility of the power production being squeezed out or even reduced.

The most efficient heat station (not rejected heat) would naturally be one from which power production was excluded, this being a raw-heat station and operating at boiler efficiency. In a modern community, however, power demands would still have to be met, thus necessitating a separate (and less efficient) power station.

The most economical source of both power and heat from the community aspect would necessarily be a combined station, the heat rejected by the one process being utilised for the other. The thermal efficiency of such a station would lie somewhere between the boiler efficiency of a raw-heat station and the steam cycle efficiency of a power station.

It is true that the paper efficiencies of such combined stations would be difficult of comparison for competitive purposes, since they would depend more on the ratio of the demands for heat and power by the community than, as now, upon small refinements in largely standardised plant, but what of that if the result is to reduce the total fuel consumption to a minimum?

Presumably Mr. Lloyd Price meant that the most efficient station would be that in which comparative efficiency figures were squeezed out altogether. That would be true, but not a paradox or much loss. To accord chief importance to comparative efficiency figures which, be it noted, are "paper" figures only, is to mistake the shadow for the substance.

It is possible, even probable, that in time to come the need for fuel conservation will involve the combination of both functions in most undertakings, but before that time engineers will have to be capable of thinking in terms of both electricity and heat supply and not the former alone. It is satisfactory that some at least are thinking along these lines at the present day.

Bath. J. P. S. PILLANS, M.I.E.E.

Single-Pole Fusing

MY letter published in your issue of November 17th described an incident which I implied may not be infrequent when single-pole fusing is in general use. Mr. W. E. Steward points out that the circuit on which the fault occurred should not have had its polarity wrong and that gas pipes should be separated from conduits.

This, of course, is correct, but it does not dispose of the fact that changes of polarity *can* occur for a variety of reasons. The most thorough check up by the supply undertaking to ensure correct polarity of circuits and separation of the conduit system from gas pipes is no guarantee that the conditions will continue unaltered for a period of many years. In this case a composition gas pipe was laid across a conduit long after the job was inspected.

The objects of my letter were twofold.

Firstly, to draw attention to possible drawbacks which I think far outweigh the small economic and other benefits gained by dispensing with the neutral fuse. During a fairly long experience in close contact with the work of giving supply to consumers' installations, I have never known a fire caused by a blown neutral fuse, but I *have* known circuits to have their polarity unintentionally reversed. I consider the risks incurred by single-pole fusing are too great.

Secondly, effective earthing is still a problem. It is widely accepted that an earth wire need only be run to a water pipe to ensure that any fault current will be safely discharged. The installations I referred to in my first letter were both earthed to I.E.E. requirements.

A heavy fault to earth can cause a serious rise of potential on a water pipe which may be conveyed to other premises to cause fire even when the main water pipes are all of metal. Moreover, metal water pipes may give place in the near future to non-metallic ones. We have already been warned of this possibility in a booklet published by the Institution of Civil Engineers.

Compulsory registration of contractors and electricians will not avoid these errors and difficulties, nor prevent the gasfitter laying his compo pipes across electric conduits. In any case, we are no nearer compulsory registration to-day than we were ten years ago.

In conclusion I would say that far from suggesting that modern installation methods should be modified in the matter of fuse protection, I suggest that the long-established practice of double-pole fusing be continued.

P. RIDLER.

Electrical Education in Schools

WITH reference to Mr. Alexander Milne's letter in your issue of December 1st regarding electrical instruction in Scottish schools, I should like to point out that he has dealt with the suggestions contained in the E.A.W. Memorandum quite apart from their relation to the whole scheme. In fact I would refer him to your editorial note which puts the facts in their proper perspective.

Far from encouraging irresponsible venturesomeness in boys or girls, this Association feels that adequate instruction should be given them in the correct use of electrical apparatus which will bring the benefits of the electrical age to every home. Item 2 of the suggested course specifically mentions "steps to be taken for safety and efficiency" and the E.A.W. believes that an understanding and real appreciation of "how electricity works" is the best way to achieve both these objectives. The Association has outlined the whole course to be covered starting from the age of 11, but individual teachers will best know which age groups in their particular schools are suited to benefit from different sections of the course.

The E.A.W., through its Home Workers' Certificate in Electrical Housecraft for Schools, has found a very great interest evinced in domestic electrical matters, together with an ability to take the instruction seriously and absorb it for the purpose for which it is given. In passing, it is interesting to note that the Board of Trade encourages dissemination of make-do and mend information which includes "How to mend a fuse" and "How to repair a frayed flex"; the Ministry of Fuel and Power has sponsored the teaching of electrical principles in schools as part of its fuel economy campaign.

With the increasing development and application of electricity in a scientific world the E.A.W. believes more strongly than ever that foundation or background knowledge should be given in the schools.

*London, S.W.*1. CAROLINE HASLETT,
Director,
Electrical Association for Women.

I.E.E. Examinations

THE letter from Dr. Hughes in your last issue is interesting in that it gives expression to a point of view of which the Education Committee of the I.E.E. Council has long been aware. It should, however, be pointed out that those who were responsible for drafting the syllabuses of the revised Associate Membership examination, included industrialists and others who were interested or directly concerned in the matter, and if this were not the case any absence of balance would have been remedied when that matter came before a widely representative Council.

It will be recognised that it is one of the Council's duties to determine the proper educational requirements for an electrical engineer. This duty is performed in a number of ways, one of which lies in setting the standard of the Associate Membership examination. In doing this it would not be proper to consider primarily the manner in which any particular subject was taught in any given time in one or other of the main avenues through which electrical engineers are trained, though of course consideration is always given to the way in which the objective can be reached by all the agencies concerned.

It is to be hoped that Dr. Hughes will have referred to the model question papers which have been issued in order to show how the syllabuses will be interpreted, because from these it will be seen that the examination papers will permit a certain degree of choice in the development of the syllabus in Applied Heat (with Light and Sound) to meet differences in the requirements in these fundamental subjects for those preparing for the various branches of electrical engineering.

The purpose of this letter is not so much

to expound the revised syllabus in this subject, which would need more space than you could spare, but more to encourage those seeking help or advice on the framing of their own syllabuses to approach the Education Committee, which has often expressed its wish to give as much help as it can to anyone engaged in the teaching of prospective electrical engineers.

*London, W.C.*2. W. K. BRASHER,
Secretary,
Institution of Electrical Engineers.

WITH reference to Dr. Hughes's letter in your issue of December 1st, apparently the I.E.E. has long been dissatisfied with the standard reached at the end of the Higher National year. The additions to the syllabus would seem to prove this.

From Dr. Hughes's description the I.E.E.'s new syllabus appears to be absolutely unpractical. According to the I.E.E. Royal Charter the object of the Institution is, in brief, the advancement of electrical science. This is making a fetish of a means, science being simply a means to an end, *viz.*, of helping us towards the common objective of happier and longer lives on this earth. Since the I.E.E. puts science first, it tends to try to make research workers of all electrical engineers. The I.E.E. should realise that the bulk of its members are very practical men (or should be): that they are not research engineers and have no facilities for research work. Until that fact is recognised the I.E.E. will tend to be too academic and unpractical.

As regards the "wave theory of light," etc., it is obvious that electrical installation work (which is not included in the syllabus) is of much more practical use and, indeed, essential. A. R. CURETON,
Bradford. Graduate I.E.E.

Age Limits

I ENTIRELY agree with Mr. E. Arthur Pinto's remarks on this subject, and it is about time that those in authority, including the worst offenders (the Government), applied a little common sense to their absurd actions. As knowledge without experience has no real value, it must be obvious that trained, active engineers of 50–65 are really valuable members of the community and should be treated as such. No doubt, however, the existing position is due to lack of interest shown in Government conduct and until that interest becomes really alive, I am afraid the present grossly unfair position will remain.

Glasgow. ALEX. MILNE.

Registration of Contractors

THE gentleman who writes from Scotland about that section of the E.C.A. membership which is not on the National Register of Electrical Installation Contractors seems to have a bee in his bonnet. I would point out that the N.R.E.I.C. is not necessarily composed of the "cream" of the industry, and that there are very many responsible, reputable and experienced engineers and contractors who are not wholeheartedly in agreement with the principle of registration. Therefore, no point arises as to their being unfitted or unwilling to fulfil the conditions of safe wiring.

It may, of course, be an offence in these enlightened days for anyone to wish to retain his individuality, but other than for that reason I can see no justice in Parliament's withholding the granting of licences to people who still believe in the intrinsic value of the individual.

*London, E.C.*4. J. MORTIMER HAWKINS,
Managing Director,
Mortimer, Gall & Co., Ltd.

Municipal Undertakings

Operating Results During the War

AMONG the first abstracts of accounts which we have received following the lifting of the ban on publication are those from West Ham and Cannock. They reflect the varying degrees in which undertakings have been affected by wartime conditions.

At West Ham (engineer, Mr. J. W. J. Townley) there was a sharp decline in sales of electricity early in the war, from 157 million kWh in 1939-40 to 124 million kWh in the following year. In the two succeeding years sales remained at much the same level, but in the twelve months to March 31st last there was a growth in all categories and the total jumped to 135 million kWh. At the same time the series of deficits which had marked the wartime operations, with a maximum of £60,220 in 1940-41, was ended and the accounts show a surplus of £15,977. Total income was £692,859 against £625,330 in 1942-43 and expenditure amounted to £549,533 (£523,694). Per kWh sold, the average price obtained advanced from 1·15d. to 1·18d. while the cost decreased from 1·21d. to 1·15d.

The accounts of the Cannock U.D.C. undertaking (engineer, Mr. P. Wardle) reveal a steady continuance of the pre-war growth of supplies, though at a slower rate. In 1938-39 sales aggregated 15¼ million kWh while by last year they had risen to 24 million kWh. Total revenue last year was £111,576, against £106,824 in 1942-43, and working expenses were £76,084 (£76,701); after meeting interest charges, there was a net profit of £4,608(£2,209).

Electrodeposition Memorandum

NOTIFICATION has been received from the Armament Research Department that by permission of the Director-General of Research and Development, Ministry of Supply, the following A.R.D. electrodeposition memorandum is being released for publication:—No. 6: Methods of obtaining adherent nickel or chromium deposits to special steel, cast iron and non-ferrous metals. Copies may be obtained on application to the C.S.A.R. Liaison Officer, c/o S.T.A.M., Room 1043, Shell Mex House, Strand, W.C.2.

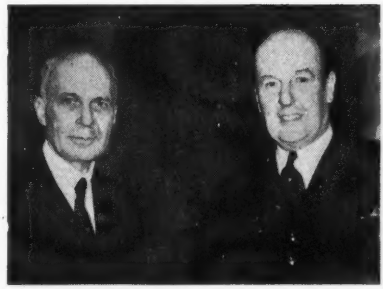
Twenty-Five Years

E.D.A.'s Contribution to Electrical Progress

WHEN the British Electrical Development Association was formed in 1919 there were 700,000 electricity consumers in this country; to-day, after twenty-five years, there are nearly 11,000,000. The capital expended by electricity authorities has risen from £100,000,000 to £700,000,000 and their annual revenue from £14,000,000 to about £125,000,000. More than one factor has contributed to this progress but it can be said with truth that E.D.A. has been responsible for the greater part and, having now reached its silver jubilee, aims at doing more than ever before.

Testimony to the high place held in the national life by electricity was afforded by the company at a celebration dinner held on Thursday last week at the Savoy Hotel; it included a number of H.M. Ministers and leaders in many walks of life. LORD BRABAZON OF TARA, the president, was in the chair and after proposing the health of the Prime Minister, who was seventy on that day, submitted the toast "Electricity." He said that the guests had been invited to be made aware of the existence of the Association because they believed that it had a big part to play in popularising electricity which would alleviate in a great way the task of the ordinary man and woman in their homes.

He indicated how electricity now permeated all phases of daily life and then referred to "alternating currents of opinion" in the electrical industry, saying that, after all, no electric generator was aware of whether it was generating electricity for a company or a municipality. They enjoyed jokes against their gas rivals but electricity supply authorities owed them a debt of gratitude because they had continued to keep electricity on its toes.

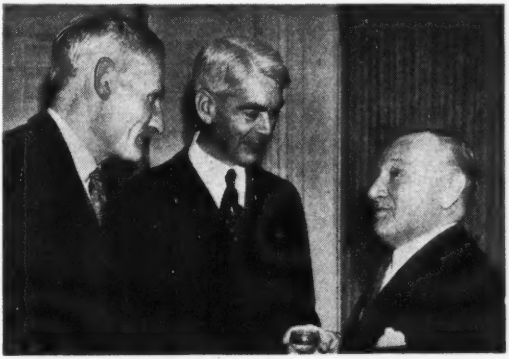


Sir Lawrence Bragg with Lord Brabazon

Lord Brabazon spoke of the scientific developments of the last few years, referring especially to the Cavendish Laboratory and its successive heads—Clerk Maxwell, Lord Rayleigh, J. J. Thomson, Lord Rutherford and the present Cavendish Professor, Sir Lawrence Bragg, with whose name he coupled the toast.

SIR LAWRENCE BRAGG, in the course of his response, said that the bond between pure research and electrical development was a natural one. Electricity was the latest great secret that we had wrested from nature. Not only had the electrical industry, more

Mr. Clarence Parker (Chairman of E.D.A. Council) and Mr. Herbert Morrison (Home Secretary)



Mr. Harold Hobson (C.E.B.), Mr. W. S. Morrison (Minister of Town and Country Planning) and Lt.-Col. S. E. Monkhouse

than any other, supplied the weapons for research it had also supplied the men. In this connection he mentioned his close contact during his period in Manchester with Metropolitan-Vickers which had provided

Messrs. E. E. Hoadley, Selwyn Jones, S. Tillotson and F. Newey

"a little galaxy of stars in pure science"—a wonderful example of "reverse lease-lend" which made scientists feel that they were the real allies of the electrical industry.

There was something romantic about electricity. We were only beginning to see the possibilities of what might be done. Sir Lawrence referred to the exciting discoveries of Volta, Faraday and Joule, and said that this was probably the last generation of householders among whom an acquaintance with electricity was the object of admiration. In the war our young people had had a technical training on a scale which never existed before and our wives in their homes were doing things previously done for them.

He viewed E.D.A.'s task as not the mere overcoming of "sales resistance." The solid foundations of what they were trying to do lay in a combination in the devices they made and used, their power of art and fitness for the purpose and the intelligence of the user. This was the foundation, it seemed to him, on which a structure of any height could be raised. He wished the Association "a glorious future."

Utilising Water Resources

Importance of Planning on the Widest Possible Basis

WATER power is the subject of a paper submitted to the Royal Scottish Society of Arts, Edinburgh, by MR. E. OPENSHAW TAYLOR (lecturer, Heriot-Watt College) who contends that when considering development the catchment area of the particular river should be considered as a whole and regard paid to all the purposes (other than power generation) for which rainfall might, and frequently must, be utilised.

The efficiency of a water power scheme should be estimated on the basis of the total potential energy of the rainfall as it reaches the catchment area. When calculated in this way the value can rarely exceed 30 per cent. and is usually much less, although it compares with that of a steam power station in which only 25 to 30 per cent. of the available energy in the coal can be obtained as useful electrical energy.

To make the best use of the available water and to produce energy at the lowest cost storage reservoirs are generally necessary. By allowing the water flow to be controlled they prevent flooding and enable supplies to be furnished for irrigation and domestic uses; locks at the dams also make the river navigable. Special pumped-storage installations can provide economical assistance for the purpose of meeting peak loads.

The labour required to produce a given amount of electrical energy from water is less than a third of that required to produce the same energy from coal and the conditions under which the employees work are much superior to those obtaining in the coal mines and steam power stations. Various means can be adopted for avoiding the destruction of scenic beauties in the neighbourhood of a water power installation and in many cases the amenities can actually be enhanced.

The reasons for making the best possible use of water power resources are reiterated and it is concluded that, in view of the wide range of interests involved in the development of any scheme, the planning can only be carried out on the widest possible basis.

Hard Surfacing by Welding

A PAPER on the use of welding for "hard surfacing" has been presented to the Institute of Welding by Mr. M. Riddihough (technical manager, Deloro Smelting & Refining Co., Ltd.) which commences with some historical notes on the development of the process and then outlines the types of alloy-rod called for by the major industries and service conditions encountered.

Typical analyses of available alloys are included, these being classified into those containing less and more than 20 per cent., nonferrous and tungsten carbides. The author proceeds to discuss the technique of face hardening in relation to cracking as well as deformation and refers in detail to recommended heat treatments for most types of steels.

PERSONAL and SOCIAL

News of Men and Women of the Industry

TO celebrate the silver jubilee of her entry into the House of Commons, **Lady Astor** was on Thursday last week entertained to tea by the Electrical Association for Women. She was the Association's first president on its formation twenty years ago and has been closely associated with its work ever since. In 1925 during the British Empire Exhibition at Wembley she was chairman of the first day of the International Conference of Women in Science, Industry and Commerce, of which H.M. the Queen (then H.R.H. the Duchess of York) was president. On behalf of the Association, Miss Caroline Haslett, the director, presented Lady Astor with a china coffee set, together with confectionery made by members of the Housecraft School.

Mr. A. B. Catling, A.M.Inst.C.E., A.M.I.E.E., borough electrical engineer and manager, Barking, has been appointed borough electrical engineer and manager at Willesden.

Mr. A. B. Catling

Mr. H. Pryce-Jones, engineer and manager of the Brighton electricity undertaking, recently addressed the Brighton Rotary Club on "Electricity Supply." He stressed the serious effect of the progressive increase in coal prices upon production costs of electricity, and emphasised that these repeated increases in the cost of fuel were so numerous and heavy as to outstrip the endeavours of engineers to counteract them by improvements in technical design and operating efficiency.

Fifty applications (twenty-nine of them from non-members) were received by the Electrical Power Engineers' Association for the two vacancies for assistant general secretaries. **Mr. C. H. Norton,** assistant superintendent, Sheffield Corporation, was selected for the position of secretary of the Northern Area. No second appointment was made; the matter is to be held in abeyance for six months by when, it is hoped, more members will be free to apply for the position. The appointment of a technical editor was considered at the same time but none of the applicants was selected.

Mr. Colin M. Mundie, resident engineer of the Galloway Water Power Co. at Castle Douglas, has now been released by the Ministry of Labour and National Service to take up duty as burgh electrical engineer of Stirling in succession to Mr. William M. Murray who is retiring.

Mr. F. S. Martin, a director of Gilbert-Lodge & Co. (Pty.), Ltd., of Australia and New Zealand, is expected to arrive in England shortly. He would like to get in touch with firms wishing to extend their business in the above countries either by selling their products or in arranging local manufacture. His address will be c/o Chamier, Gilbert-Lodge & Co., Aldwych House, Aldwych, London, W.C.2.

Mr. E. W. Dorey, M.I.E.E., has moved to Church Road, Birdham, near Chichester, Sussex.

Mr. Leslie Gamage, vice-chairman and joint managing director of the General Electric Co., Ltd., is the new Master of the Glaziers Company, a position which was also held by his father-in-law, the late Lord Hirst, former chairman of the G.E.C.

Sir Leonard Pearce, engineer-in-chief of the London Power Co., Ltd., has been elected an honorary member of the American Society of Mechanical Engineers.

Mr. A. E. Mills, commercial manager; **Mr. R. W. Dowsett,** assistant general manager (works); **Mr. A. Johnstone,** works manager; and **Mr. N. Leevers,** supplies manager, have been appointed executive directors of M.K. Electric, Ltd.

At the annual general meeting of the Junior Institution of Engineers held on November 17th **Mr. R. Lowe** was elected chairman and **Mr. L. S. Atkinson** vice-chairman.

A record gathering of apprentices, their parents and officials of the English Electric Co., Ltd., assembled in the Association Hall at the company's Stafford Works on November 17th, on the occasion of the annual presentation of

At the presentation of indentures and merit awards to English Electric apprentices. Front row, from left to right: Messrs. F. Caunce, A. H. Wroe, A. D. Sloan, J. W. C. Milligan, the Mayor of Stafford (Coun. H. Wallace Copland), the Deputy Mayor (Coun. A. E. Hourd), J. Rogers, C. C. H. Wade, M. Landers and W. K. Foster. R. L. McNaughton, winner of the Milligan Shield, is seen in the centre

indentures and merit awards to apprentices. During the afternoon many of the parents of the apprentices had inspected the works to see the type of work on which their boys were engaged and to see the training facilities provided. Among those present in the evening were the Mayor of Stafford (Councillor H. Wallace Copland), the Mayoress, the Deputy Mayor (Councillor A. E. Hourd) and Dr. and Mrs. W. A. J. Chapman. Dr. Chapman is the newly appointed principal of the Stafford Technical College who takes up his appointment in January next. The company's officials included Mr. J. Rogers, general manager of works; Mr. A. D. Sloan, chief engineer; Mr. J. W. C. Milligan, manager, Stafford Works; Mr. C. C. H. Wade and Mr. A. H. Wroe, managers of the plant and transformer and switchgear works respectively; and Mr. M. Landers, chief engineer, fusegear works. The chair was taken by **Mr. F. Caunce,** superintendent of the company's technical education department, who welcomed the visitors and parents to the function and gave a short review of the progress and aims of the apprentice training scheme. He announced that arrangements had been made with the education authorities for day continuation classes for all boys and girls under sixteen, to commence in January. (Mr. Caunce described the company's educational system in the *Electrical Review* of April 14th last, *p.* 513.)

Mr. Milligan, after distributing completed indentures and merit awards, read a message from Sir George Nelson, chairman and managing director, and went on to single out for special mention two apprentices—Ronald McNaughton and Derek Senhenn. The former is this year's winner of the Milligan Shield which is presented to the apprentice who, in the opinion of the management and the apprentices themselves, is the best all-round apprentice of the year. Mr. Milligan said it was the policy of the company, as soon as possible, to raise the age limit for day continuation classes to eighteen, and added that so far as the management could foresee there were ample orders and work already booked which would mean plenty of work and opportunity for the next five years or more. They had enough material things to tackle the work but it was most important that the apprentices should equip themselves fully to meet the challenge of these years.

Mr. L. O. Cox, A.M.I.E.E., mains superintendent at Leyton, has retired for health reasons after forty-one years' service. Mr. Cox went to Leyton as mains superintendent in 1903 and has been in charge of the mains, meter and public lighting department ever since. During this time he has been concerned in the many developments which have taken place in Leyton, particularly the big change-over scheme which was completed just before the war. Mr. Cox is succeeded by **Mr. W. O. Heather,** assistant mains superintendent.

Mr. W. H. Duncan, A.M.I.E.E., who retires on December 11th, from the position of chief mains and installation engineer with the Manchester Corporation Electricity Department, was, after apprenticeship, trained with the Harrogate Corporation Electricity Department, with whom he subsequently held positions at the generating station and as testing assistant. In 1906 he joined the Newcastle Electricity Supply Co. and supervised the first installation of 20,000-V, 3-core cable in the world. Later he was in charge of the Cleveland and Durham Co's. transmission and distribution systems, operating from Middlesbrough. Returning to Newcastle-on-Tyne in 1921, he was responsible for the maintenance of mains in the Northumberland area of the N.E.S. Co. In 1923 he was appointed assistant to the constructional mains engineer of the whole of the N.E.S. Co. areas. In 1927 he joined the staff of the Manchester Electricity Department as mains engineer, and subsequently was appointed chief mains and installation engineer. Mr. Duncan's successor will be **Mr. A. J. Lovell,** A.M.I.E.E., with **Mr. F. Linley,** A.M.I.E.E., as his chief assistant.

Sir Stafford Cripps, Minister of Aircraft Production, recently made a tour of the works of Rist's Wires & Cables, Ltd. Sir Stafford, who was accompanied by Lady Cripps, congratulated the company on its satisfactory output and the quality of its products, adding that it was quality of British production, rather than quantity, which had given us supremacy in the air all over the world.

Mr. H. A. Neville, M.I.E.E., city electrical engineer and manager of Peterborough for the past twenty-five years, is to retire next February, and **Mr. G. N. Green,** M.I.E.E., who went to Peterborough in June as his deputy, will succeed him. The City Council is advertising this week for a deputy engineer and manager.

Mr. J. E. Pownall, deputy borough electrical engineer of Tunbridge Wells, is to retire early next year. He has been with the Corporation for thirty-one years, having been appointed to his present position in November, 1913. He commenced his career at Bolton and subsequently served with the electricity undertakings at Dover, Hammersmith and Hampstead.

Mr. F. R. Gilks, who has been with the Leicester Corporation Electricity Department for some years, latterly as district main's engineer, has joined the technical staff of the English Electric Company's fusegear section.

Obituary

Mr. T. E. Merry.—We regret to learn of the death of Mr. T. E. Merry, for many years Birmingham representative of the Hotpoint Electric Appliance Co., Ltd. He had been ill for only a short period and died at Queen Elizabeth Hospital, Birmingham, on November 16th. Mr. Merry joined the Hotpoint Co. in 1931 and was attached to the Nottingham branch. When the Birmingham branch was opened in 1933 he was transferred there, and in January, 1942, he was seconded for duty with the Ministry of Supply, Birmingham Region.

Mr. H. E. Bowen, of Netheredge, Sheffield, who had been district representative for E.M.B. Co., Ltd., West Bromwich, for the past sixteen years, died recently.

Mr. H. A. Davies.—The death is reported at the age of seventy-one of Mr. Henry A. Davies, a member of the West Midlands Joint Electricity Authority since its formation.

Mr. G. S. Batterby.—The death has occurred at the age of fifty-four in a London nursing home of Mr. George Sydney Batterby, founder and managing director of the Derby electrical engineering firm of Batterby & Hefford, Ltd., and a well-known member of the Electrical Contractors' Association.

COMMERCE and INDUSTRY

Release of Heaters. Small Fluorescent Lamps on Underground.

Heating Apparatus Supplies

THE Board of Trade, in consultation with the Ministry of Fuel and Power, has decided that it is no longer necessary to limit sales by wholesalers of electrical heating apparatus, or sales by either manufacturers or wholesalers of gas heating apparatus. The Limitation of Supplies (Heating Apparatus) (No. 4) Order, 1944, has accordingly been revoked by an Order (S.R. & O. 1944 No. 1326) which came into operation on December 1st. Manufacturers of electrical heating apparatus "of a kind suitable for domestic or personal use" should, however, note that they are still subject to control as regards goods of their own manufacture. They may not manufacture or supply such goods except on the authority of a licence issued by the Board of Trade under the Electrical Appliances (Control of Manufacture and Supply) Order, 1942 (S.R. & O. 1942 No. 1453).

Extra Clothing Coupons for Workers

Ten additional clothing coupons are again to be issued to a wide range of manual workers in agriculture and industry for the current rationing period. Details of the workers eligible and of the method of application and issue are set out in leaflet T.C. 45 which is obtainable from local offices of the Ministry of Labour and National Service. This extra ration is similar to that given out in the 1943-44 rationing period and the categories of workers eligible are mainly the same.

Loans for New Industries in Ulster

The Government of Northern Ireland proposes to renew for a further two years the New Industries Development Acts, 1937 and 1942, which authorise the making of grants and loans to enable sites to be obtained and premises to be provided for new industries and the exemption of such premises from local rates. The extension of these powers granted by the 1941 Act expires on December 31st next.

Specialists in Building

At a luncheon in London last week arranged by the Federation of Associations of Specialists and Sub-Contractors (to which the Electrical Contractors' Association is affiliated) the president, Mr. J. L. Musgrave, M.Inst.C.E., pledged the Federation's support for the Ministry of Works. He was proposing the health of "His Majesty's Government." He said, however, that if there was to be planning they must know the objective. For this reason he hoped that the ability of specialists to give constructive advice and assistance would not be overlooked. Stressing the essential part which the specialist played in modern building, Mr. Musgrave hoped that the building industry's contribution to the post-war world would not be confined to housing, which could not of itself absorb all the employees who were engaged on site construction before the war.

Replying to the toast, Mr. George Hicks, Parliamentary Secretary to the Ministry of Works, referred to the recent change of Ministers and said that he appreciated the important part played by specialists in modern building. When he entered the building industry forty or fifty years ago the master builder did everything; now from 15 to 20 per cent. of workers on buildings were the employees of specialist subcontractors. The Ministry had instituted arrangements whereby the best use would be made of the services of specialists. Favourable attention was being given by the Ministry to the appointment of an advisory committee of specialists.

The health of the guests was proposed by Mr. Douglas Green, O.B.E., chairman of the Council, and Mr. A. L. Roberts, vice-president, R.I.B.A., replied.

Economics of Water Power

Sir Alexander Gibb states that in his recent address to the Institution of Chemical Engineers on "Hydro-electric Development in Great Britain" (*Electrical Review*, November 3rd, p. 636) an incorrect figure was quoted for the percentage cost of power in the manufacture of electrolytic magnesium. The figure should have been 20 per cent. (not 2 per cent.) which, at a power cost of ¾d. per kWh, might make difficult the production of this material at competitive prices.

Housing Manual Appendices

Among the subjects covered by Technical Appendices (C to L) to the Housing Manual (Stationery Office, 1s. 6d.) are cooking, heating, water heating, clothes washing and drying, and internal services generally. The section on room heating deals with convection and radiation, background warmth, smoke abatement and the particular advantages of electric heating, while in connection with water heating reference is made to optimum temperatures, lagging and the best methods to employ for principal and auxiliary water heating. With regard to the electrical installation it is recommended that the current Regulations for the Electrical Equipment of Buildings (11th edition, revised) issued by the Institution of Electrical Engineers should be followed wherever possible, but any variation in favour of room or ring main circuits would, it is stated, probably be accepted by the local supply authority, which should be consulted. A list is given of British Standards specified for electricity supply, etc., in the Manual.

Bedford Wants Electric Houses

The Bedford Council, at its meeting on November 28th, decided that the Ministry of Works should be requested to supply the 143 prefabricated houses allocated to Bedford electrically equipped throughout.

Gauge and Tool Makers

The annual general meeting of the Gauge and Tool Makers' Association is being held on Thursday, December 14th, at 2.30 p.m. at the Savoy Hotel, London, W.C.2. It will be

preceded by a trade luncheon at 12.30 (reception) for 1 p.m., at which the principal guest and speaker will be Sir Percy H. Mills, formerly Controller-General of Machine Tools, Ministry of Supply, and now Chief of the Economics Division of the Control Commission for Germany (British Element). Other guests at the luncheon will include the new Controller-General of Machine Tools, Mr. S. F. Steward, and other officials and directors of the Machine Tool Control.

Smaller Fluorescent Tubes

A new, smaller type of fluorescent tube employed experimentally on one of the District Railway cars will have many other applications after the war. It is 2 ft. long and has a loading of 20 W. Twelve of the tubes running down each side of the roof over the passengers' heads give the effect of practically continuous bands of light. Each passenger has good light wherever he sits and the daylight effect is more restful to the eye than the yellowish light from ordinary lamps. Considerable saving in electricity is effected too, the total wattage of 480 W comparing with 2,100 W required with the standard arrangement of thirty-five 60-W lamps. The car in which the new lighting has been installed is an old one and has not been specially designed to make the most of the new system of illumination.

20-W, 2-ft. fluorescent lamps installed in a District Railway coach

Northolt Demonstration Houses

Twenty-four pages of pictures on art paper are included in "Demonstration Houses," a booklet produced by the Ministry of Works (Stationery Office, 1s.) describing the demonstration houses and flats erected at Northolt for the purpose of estimating probable post-war costs of methods of house building advocated in the Housing Manual, 1944. Plans and full constructional details are given.

Extensions at Pyrmont

As already reported, the Sydney (N.S.W.) County Council has placed contracts for the plant required for extensions at its Pyrmont power station. The Council accepted the tender of the Australian General Electric Pty., Ltd., for a 50,000-kW turbo-alternator manufactured by Metropolitan-Vickers (England) together with condensing and feed heating plant to be manufactured in Australia by Thompson's Engineering & Pipe Co., Ltd. The latter part of the contract is to be in accordance with the tender of C. A. Parsons & Co. (England).

The *Electrical Engineer & Merchandiser* (Melbourne) reports that six British tenders were received and one Swedish. The last-named, from Asea Electric (Aust.) Pty., Ltd., was the lowest, but in view of the international situation and the uncertainty of trade agreements immediately after the war the Council did not consider it advisable to enter into a contract with a foreign firm. Also, the generating voltage of 7·5 kV offered was below that decided upon by the Council's technical advisers as being the most suitable for modern generating conditions.

The contract price of the accepted tender, adjusted to Australian currency but subject to variations according to the cost of materials and labour, is £554,410. Not one of the tenders received complied strictly with the conditions of contract laid down, mainly owing to the war situation and regulations governing manufacture in England. Time of delivery is given as two years after the date on which the British Government grants permission for manufacture (which is not expected to be given during the war) and the plant is to be ready for commissioning three years after that date.

When the first plant was installed at Pyrmont in 1904 a steam pressure of 160 lb. per sq. in. was adopted. For the extensions now authorised the pressure will be 1,200 lb. per sq. in.

The Council has also accepted a tender of £A842,774 by International Combustion (A/sia) Pty., Ltd., for steam generating plant for the Pyrmont "B" station, in accordance with Specification 650.

Inquiry from India

A firm of agents in Bombay wishes to get into touch with manufacturers of electrical measuring instruments, including house service and power meters, and ironclad switch- and fuse-gear, with a view to acting as their representatives in India. We shall be glad to pass on our inquirers' name to any interested manufacturers.

Petty Officer's Death

A shock received while connecting up his ship with the shore supply caused the death of Petty Officer William Coull, aged thirty-eight. At the inquest a shore official said that the correct procedure, although frequently it was

not carried out, was to communicate with his office and a man would then be sent to make the necessary connection. There was no risk if the cable was connected to the ship, then run ashore, connected to the plug and switched on. What might have happened was that deceased carried the cable across to the ship with the switch already on. It was raining heavily and this would increase the severity of the shock. A verdict of "Death by misadventure" was recorded.

Damages Award

At Manchester Assizes last week a settlement of £1,326 was approved by Mr. Justice Stable in a claim for damages by Mrs. Lena Cook against the Stalybridge, Hyde, Mossley and Dukinfield Joint Transport and Electricity Board for the death of her husband who received a fatal shock while working on a 6,300-V line at Hollingworth. The Board, it was alleged, had been negligent in allowing the line to be charged with electricity.

Dutch Order for U.S. Generating Sets

It is expected that the cost of a Dutch order for six generating sets placed with the Westinghouse Electric and Manufacturing Company will amount to more than $1,000,000. Delivery is expected between February and April, 1945. The plant is part of a drainage programme costing $12,000,000, half of which will probably be expended on power plants to run the pumps which are to drain Holland's flooded lowlands. Orders for 200 pumps have already been placed with an American manufacturer, reports the *Wall Street Journal*. The power plants comprise four 2,000-kW and two 1,000-kW generating sets. They will all be driven by high-pressure steam turbines.—*Reuter's Trade Service.*

Control of Effluent

At Jedburgh Sheriff Court a fine of £1 was imposed on the manager of North British Rayon, Ltd., for contravening the Tweed Fisheries Act, 1857. It was stated that effluent from the acid house, after being neutralised, was carried into the River Jed, but on the day of the offence the neutralising system failed to act. The result was that crude acid flowed into the river. For the company it was stated that the flow of acid was electrically controlled, and on that day the system was brought to a standstill by a breakdown of the Jedburgh electricity supply. The breakdown lasted eight minutes.

Fluorescent Lighting Prosecutions

At Bolton on November 30th George H. Cobb, Derby Street, Bolton; the Engineering Service Co., 18, Market Street, Bolton; Edwin Lees, St. Helens Road, Daubhill; Ernest Kirby, Phillip Street, Bolton; and the Hulton Motor Co., Over Hulton, were summoned for installing fluorescent lighting without a licence. For the prosecution it was stated that the Order was introduced because the demand for the lamps was greater than the supply, and they were required for essential work. In only one case, at a mill, would a licence have been granted.

Counsel for Cobb said that, as an electrical engineer, if he had applied for a licence it would have been granted. Such lighting was beneficial and saved electricity. The Engineering Service Co. contended that the lamps were not in short supply as had been suggested. The company had a considerable number in stock. It received travellers regularly who offered these lamps and was being pressed by manufacturers to accept delivery. Such lighting was a saving and helpful to workpeople. Lees was stated to have installed the lighting at Oakenbottom Mills and other premises and also on his own premises for demonstration purposes. Kirby claimed that it was possible to buy the lamps anywhere.

Cobb was fined a total of £13, the Engineering Service Co. £12, Lees £11, Kirby £3 and the Hulton Motor Co. £3, with costs in each case.

Preston Tenants' Choice

The Preston Town Council recently defeated, by 31 votes to 11, a move to delete a decision informing the Housing Committee of the Electricity Committee's opinion that all new Corporation dwellings should be provided with electric cooking and heating facilities. The Town Clerk said the resolution would not prevent a Corporation tenant having gas installed if desired. Alderman Rhodes expressed surprise at the Town Council which was the custodian of the electricity undertaking "boosting another manufacturers' goods." On Holme Slack site, 95 per cent. of the tenants had themselves borne the cost of electrifying their dwellings.

Exports to Turkey

Applications for licences to export a number of classes of goods to Turkey can only be considered if recommended by the British-American Co-ordinating Committee. Turkish consignees should therefore be advised by their British exporters to submit their orders for these goods through the Turkish Bureau Centrale des Commandes for examination by the B.A.C.C. The exporter will be advised of recommendations through the United Kingdom Commercial Corporation. The goods scheduled include electrical machinery and apparatus (not including parts unless elsewhere specified); insulated wire and cable; refrigerators; and welding electrodes.

Colombian Schemes

The Colombian Minister of Economy has proposed to Congress a plan to increase Colombian industrial production by a thousand million pesos in five years. *Reuter* learnt recently that the Colombian Government is considering a scheme to join the Chinchina and Campoalegre Rivers by a canal about 4,375 yards long and a tunnel of about 1,300 yards, whereby 4,500 kW could be generated. There are also schemes in hand for the erection of six hydro-electric plants in Boyaca which will cost five million pesos. The construction of a plant on the Anchicaya River has been started, and its capacity in about three years will be 12,500 kW, eventually rising to 60,000 kW.—*Reuter's Trade Service.*

Trade Announcement

Read & Partners, Ltd., have moved to 28/30, Hatfields, Stamford Street, London, S.E.1. The telephone number and telegraphic address remain the same. The stores address is 79, Broadwall, Stamford Street, London, S.E.1.

Turbo-Generator Design

Suggested Unification of Performance Requirements

ECONOMY in the use of materials and in the expenditure of man-power, together with assurance of maximum availability of a particular item of equipment, are most satisfactorily effected by making the machine, or its parts, completely interchangeable. The benefits are greatest in the case of articles made in large quantities for uniform conditions of service, whereas standardisation to the same extent in the case of large electrical plant is very complicated because the performance demanded varies so much.

Therefore, as is argued in the paper prepared by MR. G. A. JUHLIN (Metropolitan-Vickers Electrical Co., Ltd.) for the Institution of Electrical Engineers, unification of requirements must be an important first step towards standard types of AC turbo-generators. The divergence in design is probably wider in England than elsewhere because at least six manufacturers cater for the needs of 46 million people, whereas in the United States there are only three for 130 millions and three for 80 millions in Germany, while there is only one purchaser and one manufacturer (the State) in Russia.

Standardisation would, of necessity, introduce changes in design and methods of manufacture that have been based on long experience; they are not likely to be readily accepted by machine builders unless they offer compensating advantages, while the technical difficulties involved are formidable.

The author accordingly reaches the conclusion that for both commercial and technical reasons complete unification of turbo-alternator designs must be regarded as impracticable at present, and he seems to be very doubtful whether the alternative of mechanical interchangeability would be feasible. He considers it to be extremely uncertain whether sufficient advantage would be obtainable in that way to warrant the expenditure involved and suggests that there is real danger of future developments being retarded thereby.

The necessity for unification of plant performance requirements is stressed (most of the paper being devoted to this aspect of the subject) and must precede any attempt to standardise design. The complexity of the problem makes it clear that no single section of the industry can, by itself, come to any generally acceptable conclusion on this matter. Close collaboration between all interests (meaning all the engineers involved in the design of power stations as well as those concerned with the design and operation of plant housed in them) will be essential to the solution of the problem; it would undoubtedly be beneficial to all concerned and the author suggests that steps should be taken to bring it about in order that all aspects of this vital question may receive consideration.

Revision of Lend-Lease Arrangements

Export Restrictions to be Eased

THE mission to the United States to discuss the operation of the Lend-Lease system, headed by Lord Keynes, has been able to arrange an agreement for the future working of the system with the American authorities. Mr. Churchill told the House of Commons last week that the Lend-Lease programme would be so reduced that we should be able to begin at once to increase our vital export trade and this would be intensified after the defeat of Germany.

From the beginning of next year this country would not receive under the Lend-Lease arrangements any manufactured articles for civilian use which entered into export trade nor of many raw and semi-fabricated materials, such as iron and steel and some non-ferrous metals. This would leave us free to export a wide range of goods made from those materials. We would not, of course, devote to this purpose any critically scarce materials unless the exports concerned were essential to the effective prosecution of the war. Until the German war was over there could be no significant release of resources, but after that (subject to the calls in respect of the war with Japan) it would be possible to turn over an increasing part of our resources to civilian production, including export trade.

Where we continued to receive any raw materials the quantities received under Lend-Lease would be limited to our domestic consumption for the manufacture of munitions and the maintenance of our essential wartime economy. Cash would be paid for any additional supplies which we might need for export purposes.

The Prime Minister said that this removed one uncertainty about future conditions and it should now be possible for exporters to make plans with the assurance that they would be able to give effect to those plans with the least possible delay when the defeat of Germany released man-power, capacity and materials.

An American statement made at about the same time said that during 1945 Lend-Lease supplies would amount to £1,400,000,000, roughly half of the 1944 shipments. It was understood that, as in the past, the United States and the United Kingdom would both endeavour to ensure to the extent practicable that the exporters of one nation would not receive undue competitive advantages over the exporters of the other as a result of the war situation.

Registration and Inspection—I

A Study of Canadian Methods

By E. Arthur Pinto,
A.M.I.E.E., M.E.I.C.

INFORMATION reaching Canada from England indicates that the allied questions of compulsory registration of both contractors and journeymen and of compulsory inspection and regulation of all installations are once more to the fore. It may therefore be appropriate to give some particulars of the actual working of such compulsory measures in areas where they have, in varying forms, long been in operation, thereby indicating some of the difficulties and pitfalls which may have to be met as well as showing, by a description of the procedure adopted, how such schemes can be made to operate to the satisfaction of all concerned.

It should at once be stated that registration of contractors, either with or without licensing of journeymen, is taken for granted in both Canada and the United States. No one wants to be without it and it has undoubtedly come to stay. Similarly, the compulsory observation of wiring regulations ("The Code") is the logical consequence of the registration of the men who execute the work.

On account of the very much longer distances between centres of population and the great areas to be covered, both these countries have decentralised control: in Canada by Provinces and in the United States by large cities and by States. Much of this "separatism" may be due to inter-Provincial or inter-State jealousies or to politics. From my own observation I am emphatically of opinion that no such difficulties or "politics" need, or should be allowed to, creep into the formation of any British system. Even if it is considered that different parts of the country may require different regulations, this can be effected by suitable variation of one national scheme. This would do away with the system whereby each local supply authority attempts to impose its own regulations.

With this division between cities, States and Provinces, there are, of course, differences in rules, procedure and so on between the various areas. Yet there is a great deal of uniformity as regards general principles.

Wherever I have found a strong registration authority in existence, as in the four areas which will later be described, there is a rule that licences granted in one licensing area are not valid in another. This applies both to contractors' and to journeymen's licences. There are partial exceptions and concessions in certain cases, but these are rare and always involve additional fees. This policy, as already indicated, is greatly to be deprecated and in such a congested country as England, with the very short distances between centres of population, it would lead to endless trouble.

The officials of each of the licensing authorities who were interviewed for the purpose of this article frowned upon any suggestion that supply authorities should be the licensing authorities. Bitter personal experience of the treatment meted out to contractors by supply authorities in some areas in England leads me heartily to support them in this. Their contention is, indeed, strengthened by the fact that, so far as I was able to ascertain, the power companies carry out no installation work. They recognise—and in two of the areas I visited this was very strongly emphasised—that the business of a power company is to supply power, no more and no less.

One apparent exception should be explained lest it be used as a justification for granting these powers to supply authorities in England. In the Province of Ontario, inspection is carried out by the Government but is administered by the Hydro-Electric Power Commission of Ontario. Although the H.E.P.C. is the largest supply authority, there are also numerous small companies, but for inspection purposes they come under the jurisdiction of the rules and regulations as administered by the H.E.P.C. But this body is something different from the ordinary supply authority. It does no installation work, but it carries out a vast programme of research work and it operates a great testing and standardisation department. The mark "H.E.P.C. Approved" is recognised throughout all the other Provinces—this in itself places the Commission on a pedestal seldom, if ever, attained in any other path of life in Canada—and it is agreed that this mark complies with the requirements of all recognised codes.

Little Opposition

The Hydro's chief electrical inspector says: "There is very little or no objection by supply authorities or others in the electrical industry to the Commission being engaged in the inspection business. There was a little opposition many years ago when it first undertook to do this work, but any such opposition has long since disappeared."

Closely linked with, though not a part of, the installation industry itself is the registration of engineers in Canada and the use of the word "engineer" itself. Unless one is a member of an "association of professional engineers," covering all engineers, not only

electrical, a man may not practice as an "engineer." Membership is usually by examination, though there are some alternatives in certain areas. Infringement is subject to severe penalties including imprisonment, and the holding of the highest qualifications is no defence.

Enough has now been said to make clear the strength of the power of licensing and registration authorities and how completely the whole question is covered by legislation, independent of private whims or ideas. Particulars will now be given of the actual operation in four large centres, namely the Provinces of Quebec and Ontario in Canada and, in the second part of this article, the cities of New York and Boston, U.S.A. The information given is authentic and official, having been obtained first-hand in interviews with leading officials in these areas.

Province of Quebec

Apart from the registration of engineers, which has already been dealt with, the licensing of contractors and journeymen and the inspection of installations are in the hands of the "Board of Examiners of Electricians," set up by an Act of Parliament of 1925. The rules are contained in two books published by the Ministry of Labour. These are: "Electricians' and Electrical Installations Act" (25 pages, 48 sections); and "Regulations respecting Electricians and Electrical Installations" (26 pages, 34 rules).

The Act begins with a series of definitions and provides, in general terms, that no new installation or any alteration to an installation may be made without a permit and that no permit shall be issued to anyone not in the possession of an "A" or "B" licence (see below). Other clauses provide that no public service company nor a municipal service may connect up any installation until it has been inspected and approved by the examiners and a certificate of acceptance and an order to connect have been received. The examiners may declare any existing installation to be defective and may order the necessary alterations to be made. Penalties are provided for non-compliance. Supply authorities, on an order from the examiners, must disconnect any installation declared to be defective. The Lieut.-Governor in Council may prescribe the materials and apparatus which may be used in the Provinces. He may also prohibit the sale, use of, or trading in accessories, appliances, materials, wires and cables, motors, heaters, etc., which have not been approved. The Act also deals with the fixing of fees, conduct of examinations, details of licences and many other matters.

The "Regulations" are the rules put into force by Order-in-Council under the authority of the Act. They are mainly financial, though not entirely. Six general classes of licences are provided for: "A"—Full contractors qualified by examination. "B"—Contractors being firms or companies, who must employ as a member of the company a holder of a journeyman's licence. "A2" and "B2" are licences similar to the above where the holder is in the employ of the owners of a public building. "C" is the full journeyman's licence, requiring four years' experience. "D" is for persons in charge of cinematograph machines. "E" is for "persons with a knowledge of electricity" for work only on the premises where they are employed; they must pass an examination. The "F" licence is for persons in charge of machinery such as cranes, lifts, etc. Apprentices must be registered and must train for four years. They must take the journeyman's examination within three months of concluding their apprenticeship. They do not appear to be indentured, so may change employers during their term.

Annual fees for licences are (taking the dollar at 4s.): "A" and "B," £5; "C," £1 first year, 8s. after one year; "D," "E," "F," 12s. For a temporary "A" or "B" licence for a firm whose place of business is outside the Province a fee of £10 is payable. Heavy penalties ranging from a minimum of £2 2s. per day to £10 per day with or without imprisonment up to 8 days are provided for working without the necessary licence or employing an unlicensed man. The owners of a public building, factory or the like employing electricians to carry out their own work pay a licence fee depending on the total number of persons employed: up to 100 employees £2, over 250 employees £10 for each 500, and so on.

Heavy Inspection Fees

The most serious matter, however, is the amount of fees payable for the inspection of installations. The scales occupy no less than twenty pages in the book of rules. It is quite impossible here to give a lengthy extract, but the following examples will give at any rate some idea of what these fees mean: Service switches:—Up to 60 A, 4s.; 201 to 400 A, 12s.; 601 to 1,200 A, 25s.; over 1,200 A, 33s. Wiring installation, wiring and switches only:—Up to 24 outlets, approximately 7½d. per outlet; over 24 outlets, 5d. per outlet. For fittings and apparatus, calculation is on a lampholder basis, the fees being approximately half the fees for wiring, as above. Motors:—Not exceeding 750 V: Under ¼ HP treated as lighting outlets; ¼ to 5 HP, 4s. each; 7½ to 10 HP, 6s. each; over 10 HP, 8s. each. Exceeding 750 V: Up to 50 HP, £2 each; 50 to 100 HP, £2 8s. each; over 100 HP, £3 each.

There are annual inspection fees for all installations in public buildings ranging from 8s. up to 30 A to £4 for over 600 A. All other types of work and apparatus are covered, such as garages, circuses and fairs,

farms, floor polishers and many other items. The fees are high but there does not seem to be any serious complaint and if a scheme is to be self-supporting it does not appear possible to avoid these payments. In England, on account of the lower wages and the shorter distances to be covered I estimate that a reduction of the figures I have given could be made to the extent of about 25 per cent.

A plant in which I was engaged was controlled by the Federal Government and we therefore thought we were beyond the control of the Provincial examiners. However, a man was electrocuted whilst at work and the coroner ordered the Board of Examiners to report on the installation. This took three weeks and we were presented with a bill for nearly £400. Moreover, having thus been placed under the Board and as we employ our own electrical staff we shall now apparently have to pay also an annual inspection fee, to say nothing of an annual licence of £10 for every 500 of our 5,000 or more employees.

The Province has two main offices, at Montreal and Quebec. Three examiners are employed, one being the Chief Examiner and Director of Service, who presides over all deliberations of the Board. Examinations of candidates for licences are dealt with by the Board exclusively. Sub-branches are established at thirteen other centres. In quite small districts where there would not be enough work for a full-time man, suitable local arrangements are made. Since its inception the scheme has been self-supporting, an occasional loss in one year being made up by a profit in another. It is estimated that the overhead expenses of a branch office, apart from the inspector's salary, are about £800 per annum.

The population of the Province is about 3½ millions. There are 68 inspectors, in addition to the three examiners. In Greater Montreal there are 32 inspectors and this office has 12 others covering other towns in its area. These deal with about two million of the population, the remaining 24 inspectors, under the City of Quebec's jurisdiction, being responsible for the balance. The number of inspections made varies from 70,000 to 100,000 per annum.

Province of Ontario

The system in force in Ontario in many ways resembles that for Quebec, but the differences are of sufficient interest to be worth while quoting, as they indicate a number of variations which would probably be of value in any English scheme. The rules here are not quite so stringent, in that there is a certain amount of "local option," but the final result is very similar as regards inspection and examinations, but less binding concerning registration. As already mentioned, the Hydro-Electric Power Commission holds powers as regards inspection and licensing, which are treated as separate matters.

There is no provincial law as regards licensing, but power is given to municipal authorities to enact by-laws for licensing contractors and journeymen. Many municipalities, especially the larger ones, have taken advantage of this. Examinations for licences are carried out by a Board appointed by the Police Commissioner's Department where such by-laws are in force. In each case both contractors and journeymen are represented and there is in most areas a representative of the Inspection Department of the H.E.P.C. The entire Province is covered by inspection, even the remotest parts (and some parts of Ontario *are* remote, though they have an electricity supply). Inspection is statutory, as in Quebec, and a series of rules as well as the Canadian Electrical Code, also carry statutory force.

Design and Construction Approval

An Act of Parliament gives the H.E.P.C. wide powers over design and construction of electrical work, issue of orders relating to alterations and repairs to faulty installations, connection or disconnection of installations, fees to be paid for various services of the inspectors, provision of penalties for infringement of regulations, and so on. All materials used must be "approved." Rules follow which are to put the Act into effect. The fees are also set out in detail; they cover some 14 pages of print and are arranged under 32 classifications. For the purposes of this article they may be taken as being very similar to those already described for the Province of Quebec, although there are certain variations.

The Province has 24 offices throughout its whole area. There are, in all, 59 inspectors of whom 16 deal with Toronto (about 750,000 inhabitants), Hamilton 5, Ottawa 4, London 3, etc. The others are mostly one-man areas, but in very sparsely populated areas the inspectors are part-time men with some other occupation, often with the local branch of the H.E.P.C. These men receive 75 per cent. of the total fees collected in their respective areas. The whole of the organisation is under the direct control of the Chief Electrical Inspector at the H.E.P.C. headquarters, Toronto.

The income for the whole Province rose from £38,000 in 1935 to £65,000 in 1939. The numbers of inspections carried out during the last pre-war year, 1939, in the principal towns were: Toronto, 66,159; Ottawa, 17,566; Hamilton, 11,605; London, 12,644; Chatham, 6,706. The population of the Province is about four millions.

Arrangements in the United States will be dealt with in Part II.

Bedford's Jubilee

Progress After Hesitant Start

THE fiftieth anniversary of the day on which a public supply of electricity was first afforded in Bedford by the Corporation occurred on Tuesday last and a lunch will be held next Friday to celebrate it. It was on May 1st, 1889, that the Council had under consideration a report by a Committee appointed " to consider and report to the Council upon electric lighting." On consideration of this report the Council resolved to take steps to obtain powers under the Electric Lighting Acts, and on November 22nd formally resolved to apply for a Provisional Order to supply electricity within the borough. The Order was duly granted and confirmed by the Electric Lighting Orders Confirmation (No. 3) Act, 1890, which received the Royal Assent on August 4th in that year.

Some uncertainty as to the extent of the demand for a supply of electricity appears to have existed, and there was some delay in exercising the powers. Indeed, on July 18th, 1892, it was resolved " That under the circumstances the Authority do not consider it advisable to proceed further with the Provisional Order and instruct the clerk to make application to the Board of Trade for the revocation thereof at the latest period for such application," but in September of the same year, after an interview with the Board of Trade, the resolution was rescinded.

Further delay ensued, and during the following year and a half there was some possibility of competition by a company, entitled the Bedford Electric Light Co., Ltd., which actually applied to the Board of Trade for an Order. However, following further negotiations with the Board the Council resolved, on April 9th, 1894, " That this Authority do carry out the supply in the compulsory area set out in the proposed Provisional Order of the Bedford Electric Light Co., Ltd., before January 1st, 1895."

Completed in Six Months

After that events moved rapidly, and on May 18th, 1894, the Council had under consideration and approved a scheme prepared by Mr. F. H. Medhurst, consulting engineer. A month later the Council resolved to apply to the Local Government Board for sanction to borrow £12,000 for the necessary buildings, machinery and plant. On June 25th tenders totalling £9,121 were accepted for the erection and equipment of a generating station on land belonging to the Corporation and forming part of the present site. Mr. W. Hope-Johnstone was appointed engineer and a supply of electricity was actually afforded on the following December 5th.

The Electricity Committee informs us that it hopes later to publish a history of the undertaking from the days of the first chairman, the late Councillor Robert Richards, whose portrait was lately bequeathed to the Corporation by his son, through a long line of successors culminating in the present chairman, Alderman W. E. Sowter, M.B.E. This will trace its technical development under the first engineer, Mr. W. Hope-Johnstone and his successors, Mr. R. W. L. Phillips (appointed November 1st, 1901), and Mr. P. G. Campling (appointed October 25th, 1938).

Forthcoming Events

Saturday, December 9th. — *London.* — Lysbeth Hall, W.1, 6-10 p.m. I.E.E. London Students' Section informal dance.

London.—Lighting Service Bureau, Savoy Hill, W.C.2, 2.15 p.m. Association of Supervising Electrical Engineers. " P.V.C. in Practice," by P. H. Barton.

London.—39, Victoria Street, S.W.1, 2.30 p.m. Junior Institution of Engineers. Presentation of awards and induction of new president.

Bristol. — Merchant Venturers' Technical College, 3 p.m. I.E.E. Bristol Students' Section. " Power System Operation and Maintenance," by K. H. Hope and W. A. Storey.

Leeds. — Electricity Department Offices, 2.30 p.m. I.E.E. North Midland Students' Section. " Is there a Future for Graduates in Synchronous Machine Design?" by H. C. Parker.

Monday, December 11th. — *Bristol.* — At Merchant Venturers' Technical College, 5 p.m. I.E.E. Western Centre. " Influence of Maintenance Requirements on the Design of Electrical Installation Equipment," by Hamlyn Drake.

Newcastle-on-Tyne.—Neville Hall, 6.15 p.m. I.E.E. North-Eastern Centre. " Restriking Voltage as a Factor in the Performance, Rating and Selection of Circuit-Breakers," by J. A. Harle and R. W. Wild.

Tuesday, December 12th. — *London.* — Lighting Service Bureau, Savoy Hill, W.C.2, 5.30 p.m. Illuminating Engineering Society. " The Automobile Headlamp," by Dr. J. H. Nelson.

Glasgow.—Royal Technical College, George Street, 6.15 p.m. I.E.E. Scottish Centre. " Design and Performance of Domestic Electrical Appliances," by W. N. C. Clinch and F. Lynn.

Manchester.—At Engineers' Club, 6.30 p.m. I.E.E. North-Western Students' Section. "Theory and Design of Air-Blast Circuit-Breakers," by W. M. Butler.

Wednesday, December 13th. — *Birmingham.* —James Watt Institute, 7 p.m. I.E.E. South Midland Students' Section. " Mica and Micanite," by W. B. Robertshaw.

Edinburgh.—Heriot-Watt College, 6 p.m. I.E.E. Scottish Centre. " Design and Performance of Domestic Electrical Appliances," by W. N. C. Clinch and F. Lynn.

London.—Institution of Electrical Engineers, 5.30 p.m. Transmission Section. " Valuation and Capitalisation of Transformer Losses," by W. Szwander.

Thursday, December 14th. — *London.* — Institution of Electrical Engineers, 5.30 p.m. Installations Section. " Organisation of Industrial Electrical Maintenance," by J. C. B. Nicol.

Birmingham.—Imperial Hotel. Illuminating Engineering Society (Birmingham Centre). Annual dinner.

Friday, December 15th.—*Newcastle-on-Tyne.*—At Literary and Philosophical Society's Theatre, 6 p.m. N.E. Coast Institution of Engineers and Shipbuilders. Parsons Memorial Lecture by Prof. C. E. Inglis.

Saturday, December 16th. — *Birmingham.* — Grand Hotel, 12.30 for 1 p.m. Birmingham Electric Club. Luncheon-reunion.

ELECTRICITY SUPPLY

Safeguarding Belfast Plant. Highland Distribution Scheme.

Bakewell.—SUPPLY TO HOUSES.—The Rural District Council is arranging for the Mansfield Corporation Electricity Department to provide an electricity supply to houses to be erected by the R.D.C., in the parish of Pleasley. Mansfield Corporation reports that the estimated cost is £4,100.

Bexhill.—DOMESTIC APPLIANCES.—The borough electrical engineer estimates that by the end of January every available cooker will be in use. The Electricity Committee has authorised the purchase of new cookers and utensils suitable for use with them. The utensils are to be sold and not covered by the hire scheme.

Glasgow.—MODERNISATION OF SEWAGE DISPOSAL WORKS.—A special sub-committee appointed by the Corporation Committee on Sewage Disposal recommends that the boilers at the Dalmarnock works shall be dispensed with and electric motive power used. Three electric pumps are to be installed capable of dealing with the average daily flow of 25,000,000 gallons; the cost of these is estimated at £7,800. New screens are also to be installed at an estimated cost of £2,370. The Electricity Department will be asked to carry out the necessary work in connection with the new electric cable, equipment for transformer house, supply and erection of the switchboard, etc., at an estimated cost of £2,500. It is expected that when the new plant is installed there will be an annual saving of £4,197 on present working costs. As the proposals are essential to meet immediate requirements only, the question of the post-war modernisation and future operation of the works will be further investigated.

Guildford.—SUCCESS OF METER READING EXPERIMENT.—To avoid many fruitless journeys by meter readers of the Corporation Electricity Department a scheme has recently been tried by which consumers are asked to indicate on postcards the position of the pointers on their meters. These cards are left at houses when the meter readers cannot obtain admission. The borough electrical engineer reports that the scheme has proved a great success and during the September quarter 859 postcards were delivered and 669, or 78 per cent. returned.

Lower Gornal.—OVERHEAD LINE.—The Midland Electric Corporation, Ltd., is to erect an overhead line to the Londonfields Colliery.

Macclesfield.—ELECTRICITY FOR FARMS.—The Electricity Committee is to erect overhead lines to Smith Green and Brook farms, Lower Withington.

Morecambe.—LIGHTING POLICY.—The Watch Committee has decided that future street lighting shall be by electricity and that there shall be a gradual conversion to electric lighting.

North-East Coast.—EXTENSION OF TIME.—The Councils of Sunderland, Boldon, Felling, Hebburn and Jarrow have applied to the Electricity Commissioners for an extension of one year in the time allowed to them to purchase the electricity undertakings situated in their areas under the South Shields Electric Lighting Order, 1903.

Northern Ireland.—SILENT VALLEY SCHEME.—It was announced at a meeting of the Belfast Water Board that the Works Division of the Ministry of Finance had been granted conditional permission to make borings in the Silent Valley area to test the practicability of a hydro-electric scheme.

PLANT FOR BELFAST.—The Corporation Electricity Committee has authorised the city electrical engineer to take immediate steps to expedite the ordering of equipment which will prevent a repetition of the breakdown which occurred on September 26th. The engineer recommends the purchase of a house set for installation at the Harbour power station to safeguard auxiliary supplies under abnormal system conditions. This will cost £22,000. Modifications to switchgear costing £20,000, the erection of a temporary switchboard costing £7,500 and fire extinguishing apparatus costing £520 have been approved.

North Scotland.—INQUIRY INTO BOARD'S SCHEME.—The Secretary of State for Scotland has appointed Mr. John Cameron, D.S.C., K.C., to be in charge of an inquiry which is to open at 10.30 a.m. on December 27th in Parliament House, Edinburgh, into the objections made to the First Constructional Scheme of the North of Scotland Hydro-Electric Board.

The scheme, which has been approved by the Electricity Commissioners, relates to projects at Loch Sloy, Lochalsh, and Morar. The clerk of the inquiry will be Mr. John M'Kenzie, and all communications should be sent to him at Parliament House, Edinburgh, 3.

DISTRIBUTION PROPOSALS.—Mr. T. Lawrie, secretary of the Board, speaking at Glasgow on November 30th said that the Board had just heard that its first distribution scheme, which covered the Lochalsh area, had been approved by the Electricity Commissioners and would be published very shortly. The Board would very soon, too, be giving an experimental supply to a factory in South Vist processing seaweed, and it hoped to encourage crop-drying and other developments. Dealing with the provision of domestic supplies, Mr. Lawrie said it was no use pretending that electricity could be supplied in the Board's distribution area in the West Highlands and the Islands at a profit. In every area which had yet been examined, the Board found that an appreciable annual loss must be incurred in providing domestic supplies.

Perthshire. — ELECTRIC LIGHTING AND HEATING.—It is recommended to Dunkeld (Perthshire) Presbytery that all church manses be equipped with electric light and heating as soon as possible after the war in order to reduce inside work. There are 25 manses within the Presbytery.

Sunderland. — COMPREHENSIVE LIGHTING PLAN.—The Highways Committee proposes to relight all the street lamps at a cost of £4,000. They will be controlled by a master switch.

Swanscombe. — STREET LIGHTING. — The U.D.C. is to ask the Kent Electric Power Co. to arrange a demonstration of street lighting for members of the Council to attend.

FINANCIAL SECTION

Company News. Stock Exchange Activities.

Reports and Dividends

Electric & Musical Industries, Ltd.—The consolidated profit statement for the year ended June 30th shows that, after providing for depreciation and obsolescence and crediting £3,308 (£2,188) interest on gilt-edged securities, there was a trading profit of £1,139,311 (£926,802). Pensions take £56,127 (£46,967), directors' fees £5,893 (£4,978), taxation £572,013 (£283,278) and reserve for estimated liability for income tax £323,254 (£417,222), leaving a net profit of £182,024 (£174,357). The net profit of the parent company is £149,250 (£127,500). A dividend of 8 per cent. is to be paid (compared with 8 per cent. for the previous nine months) and the carry-forward is increased from £248,539 to £253,360.

The chairman, Mr. Alfred Clark, states that it is the directors' intention after the war to continue to manufacture all the products made before the war with the exception of bicycles. The report of Lord Sankey's committee on television broadcasting is eagerly awaited and it is hoped that the recommendations will include a scheme for extending the service throughout the country immediately after the end of the war with Germany.

Crompton Parkinson, Ltd.—The accounts for the year ended September 30th last show a profit of £432,099 compared with £431,413 for the previous year. The directors recommend a final dividend on the ordinary and "A" ordinary stock of 7½ per cent. actual, making 15 per cent. for the year. A special cash bonus of 7½ per cent. on the ordinary and "A" ordinary stock is also to be paid (same). It is also recommended that £5,000 shall be paid to the trustees of the Central Benevolent Fund. A balance of £588,256 (against £488,657) is carried forward.

The British Electric Transformer Co., Ltd., reports a profit of £24,569 for 1943-44, compared with £37,000 in the preceding year. A final dividend is recommended on the ordinary shares of 6d. per share, making 9d. per share for the year (against 2s. 4½d. for 1942-43). A balance of £180 (£142) is carried forward.

General Electric Co., Ltd.—The extraordinary meeting to consider the creation of 2,000,000 4½ per cent. "C" preference shares of £1 each is to be held at Magnet House, Kingsway, on December 21st.

D. Napier & Son, Ltd., which is now controlled by the English Electric Co., Ltd., reports a profit for the year ended September 30th last of £174,376, as against £209,699, after taxation and all charges arising in connection with the transfer of control. After providing for fees and £88,038 (£131,933) for depreciation there is a net profit of £85,588 (£76,802). The ordinary dividend is maintained at 7½ per cent. and £278,061 (£231,478) is carried forward.

The Perak Hydro-Electric Power Co., Ltd.—Mr. William Shearer, the chairman, stated at the annual general meeting on November 30th that they had had some preliminary consultation with the authorities engaged in making plans for the rehabilitation of Malaya, but until they could ascertain the state of their property it had not been possible for them to do much more than to indicate approximately what they considered might be the minimum plant requirements to enable them to recommence operations in Malaya.

Cape Electric Tramways, Ltd.—Preliminary figures show that for the year ended June 30th last increased revenue amounting to £37,000 has been offset by increased operating expenses. Profits amounted to £47,809 (£52,740). Replacements reserve again receives £20,000 and a dividend of 6 per cent. (same) is to be paid, leaving £61,769 (£63,433) to be carried forward. Capital expenditure fell from £46,041 to £16,477.

The British Thermostat Co., Ltd., records a profit for the year ended January 31st last amounting to £34,799, as compared with £34,754 in the previous twelve months. Obsolescence reserve again receives £5,000 and a final dividend of 11 per cent. maintains the total distribution at 18½ per cent., leaving £17,833 (£15,783) to be carried forward.

The St. Austell & District Electric Lighting & Power Co., Ltd., is to hold a meeting on December 19th to consider alterations to the articles permitting an increase in the number of directors from five to seven. It is also proposed that a director unable to attend board meetings may appoint a proxy.

John I. Thornycroft & Co., Ltd., are to pay a final dividend of 8 per cent., again making 13 per cent. for the year. A sum of £50,000 (same) is transferred to general reserve and the carry-forward is increased from £105,533 to £110,718.

Dictograph Telephones, Ltd., are paying a final dividend of 6 per cent. and a bonus of 1 per cent., making 11 per cent. (10 per cent.) for the year. The net profit, after providing for E.P.T., amounted to £36,318 (£35,005).

Aeronautical & General Instruments, Ltd., report a net profit of £29,527 for 1943-44 (against £28,930) after providing for fees, depreciation and E.P.T. (£30,000). The final dividend is 7½ per cent., making 14 per cent. (against 12½ per cent.).

Heenan & Froude, Ltd., from a net profit of £47,368 (against £42,487) are paying a final dividend of 5 per cent., again making 10 per cent. for the year, plus a cash bonus of 5 per cent. (same).

David Brown & Sons (Huddersfield), Ltd., announce that they have acquired control of Muir Machine Tools, Ltd., makers of high-speed turbine gears and gear-making machines.

Joseph Lucas, Ltd., have declared a final dividend of 12½ per cent., making 15 per cent. (same) for the past year.

Marco Refrigerators, Ltd., is paying a dividend of 2½ per cent., which compares with 5 per cent. for last year.

Thomas de la Rue & Co., Ltd., are maintaining their interim dividend at 10 per cent.

Edmundsons Electricity Corporation, Ltd., is again paying an interim dividend of 2½ per cent.

New Companies

John R. Jenkins & Co., Ltd.—Private company. Registered in Edinburgh November 23rd. Capital, £2,000. Objects: To carry on the business of electrical engineers, manufacturers of and dealers in all classes of electrical machinery and plant, etc. Directors: J. R. Jenkins, Carriden, Arthur Avenue, Airdrie, and Agnes Main, 18, Anderson Street, Airdrie. Registered office: 44, Graham Street, Airdrie.

Controls & Switchgear, Ltd.—Private company. Registered November 24th. Capital, £500. Objects: To carry on the business of specialists in electrical control gear and switchgear, electrical, acoustic, radio and television engineers, manufacturers of instruments and ray equipment, etc. Subscribers: E. C. Gimbell, 77, Beresford Crescent, Newcastle, Staffs; W. Jackson, 56, Buckingham Road, Morecambe; and C. N. Fraser, 5, Valley View, Jarrow-on-Tyne.

William E. Potter, Ltd.—Private company. Registered November 25th. Capital, £5,000. Objects: To acquire the business of an electrical and wireless engineer and manufacturer carried on by W. E. Potter at 135, Prescot Road, Liverpool. Directors: W. E. Potter and Winifred A. Potter, both of Wynstead, Southport Road, Freshfield, Lancs. Registered office: 135, Prescot Road, Liverpool.

Savage Transformers, Ltd.—Private company. Registered November 28th. Capital, £1,000. Objects: To carry on the business of electrical, radio and acoustic engineers, etc. Directors: W. B. Sawyer and Mrs. Jeanne L. Sawyer, both of 51-52, Northgate Street, Devizes. Registered office: 51-52, Northgate Street, Devizes.

H. N. Gray, McFarlane & Co., Ltd.—Private company. Registered in Edinburgh November 28th. Capital, £1,000. Objects: To acquire the business of a radio engineer carried on by H. N. Gray, 10, West Campbell Street, Glasgow. Directors: H. N. Gray, 87, Hillhead, Kirkintilloch; and R. McFarlane, 24, Rockbank Street, Glasgow. Registered office: 187, West George Street, Glasgow.

Radio Subscriptions, Ltd.—Private company. Registered November 23rd. Capital, £1,000. Objects: To carry on the business of television and radio engineers and dealers, etc. Subscribers: R. B. Stoney, Holmlea, Durrington, Wilts, and Elfrida E. Weaver, 1, Queen's Park Gardens, Bournemouth. Registered office: Upper Hinton Chambers, Bournemouth.

Ranelagh Radio & Electrical Co., Ltd.—Private company. Registered November 28th. Capital, £500. Objects: To acquire the business carried on by F. H. Brooke and E. R. Bird at Paddington as the Ranelagh Radio Repair Service. Directors: E. R. Bird, 11, Hereford Road, W.2, and F. H. Brooke, 10a, St. Edmunds Terrace, N.W.1. Registered office: 55, Westbourne Grove, W.2.

Companies to be Struck off Register

Unless cause is shown to the contrary the following companies will be struck off the register at the expiration of three months from December 1st and will be dissolved:—Kenselectric, Ltd.; Neon Signs (Sheffield), Ltd.; Northern Electric (London), Ltd.; and Piccadilly Radio, Ltd.

Companies' Returns

Statements of Capital

National Accumulator Co., Ltd.—Capital, £350,000 in £1 shares (175,000 preferred ordinary and 175,000 deferred ordinary). Return dated June 21st. All shares taken up. £292,616 paid. £57,384 considered as paid. Mortgages and charges: Nil.

East Anglian Electric Supply Co., Ltd.—Capital, £1,000,000 in £1 shares (40,000 preference and 960,000 ordinary). Return dated May 10th (filed July 15th). 2,581 preference and 600,000 ordinary shares taken up. £563,419 paid. £39,162 considered as paid. Mortgages and charges: £750,000.

Cornwall Power Co., Ltd.—Capital, £400,000 in £1 shares (250,000 ordinary and 150,000 preference). Return dated May 10th (filed July 15th). All shares taken up. £190,007 paid. £209,993 considered as paid. Mortgages and charges: Nil.

Merthyr Electric Traction & Lighting Co., Ltd.—Capital, £100,000 in £5 shares (6,000 preference and 14,000 ordinary). Return dated June 30th. 6,000 preference and 13,000 ordinary shares taken up. £95,000 paid. Mortgages and charges: Nil.

Bideford & District Electric Supply Co., Ltd.—Capital, £160,000 in 160,000 ordinary shares of £1 each. Return dated July 6th. All shares taken up. £148,400 paid. £11,600 considered as paid. Mortgages and charges: Nil.

G. L. Adamson, Ltd.—Capital, £7,500 in £1 shares. Return dated August 4th. 6,236 shares taken up. £1,736 paid. £4,500 considered as paid. Mortgages and charges: Nil.

Union Cable Co., Ltd.—Capital, £100,000 in £1 shares. Return dated June 29th. All shares taken up. £100,000 paid. Mortgages and charges: Nil.

Increase of Capital

Thomas Hill (Steam & Electrical Vehicles), Ltd.—The nominal capital has been increased by the addition of £8,000 in £1 ordinary shares beyond the registered capital of £2,000.

Mortgages and Charges

Stokes Appliances, Ltd.—Assignment of proceeds of contract, dated November 13th, to secure all moneys due or to become due from the company to Midland Bank, Ltd.

Euston Manufacturing Co., Ltd.—Satisfaction to the extent of £316 13s. 4d. on October 20th, of debentures registered November 6th, 1942.

Bankruptcies

T. Johnson, mechanical and electrical engineer and contractor, lately carrying on business as Tom Johnson & Co., 25, Granville Street, Sheffield.—Order made November 2nd, discharging debtor as from December 2nd.

H. A. Mayhew, electrical contracting engineer, 96, London Road, Apsley, and 30, Elmer Gardens, Edgware.—First and final dividend of 1s. 0½d. in the £ payable December 15th, at the Official Receiver's Office, 42, Tavistock Square, London, W.C.1.

STOCKS AND SHARES

TUESDAY EVENING.

MONEY in plenty seems to be available for investment in Stock Exchange securities. Gilt-edged prices are on the rise; Home Railway stocks make a good showing; domestic industrials are in persistent demand. The ambitious post-war policy of the Central Electricity Board serves to augment the previous strength of shares in the many companies likely to participate in the proposed expenditure of ninety million pounds upon power plant extensions.

Rises in British Insulated, Callender's and Henley's indicate the favourable post-war prospect which the buyers foresee. The Crompton Parkinson dividend and bonus are the same as last year, 22½ per cent. together. Some optimists had looked for an increase.

Rising Prices

Most of the advances secured last week by prices in the equipment and manufacturing group have been held. In some cases there are further gains. English Electrics have put on 1s. 6d., to 55s. General Electric at 97s., General Cable at 16s., and Revo at 44s., are all 1s. better. Electric Construction at 58s. 9d. improved by 1s. 9d. Tube Investments at 5$\frac{1}{16}$, and Switchgear & Cowans at 20s. 9d., are 1/16 up. Electricity supply shares are a quiet market. Electric Supply Corporation, at 50s. 6d., have added 6d. to their last week's rise. In the overseas list, Victoria Falls are up to 87s. 6d., Tokyo Electric sixes reacted 2 points to 26 and Perak Hydro-Electrics eased off to 13s. Burco at 16s. 7d. have lost 9d.

The radio market is quiet; interest has drifted for the time being into various other directions. Philco came back to 14s. 6d.; McMichael to 8s. and Cossor to 24s. E.M.I. remain at 36s. 3d.

Home Railway Possibilities

Home Railway stocks are again better. Whether or not there is any solid ground for it, the impression has spread that the Government will offer, as a matter of grace, better terms to the companies than the present ones. Southern Railway stocks are better, the preferred at 78½, and the 5 per cent. preference at 120½, being a point to the good. London Passenger Transport 5 per cent. "B" and the "C" stocks have gained about 1 in each case. Tilling shares hold their rise at 62s. British Electric Traction deferred has gone back to 1200.

Crabtree Electrical

Since the annual report of Crabtree Electrical Industries appeared in the middle of November, the price of the 10s. ordinary shares has hardened to 43s., at which the yield is £4 1s. 4d. per cent on the money. The company has been paying 17½ per cent. annually for years past, the earnings being, as a rule, considerably above this rate. The trading profit for the year ended October 31st, 1938, was £169,000; for the year ended October 31st last it was £244,000. Taking the same two years for comparison, tax in 1938 cost the company £61,684, being just £100,000 less than that of the year recently ended. The company came out in November, 1938, the object being to acquire shares and interests in companies engaged in the manufacture of electrical apparatus and equipment. The present issued capital is £950,000, of which £600,000 is in 10s. ordinary shares.

General Electric

The General Electric Co., Ltd., has called a meeting for December 21st in order to consider a resolution for creating 2,000,000 4¼ per cent. "C" preference shares. These will be subscribed for, as already mentioned, by Morgan Grenfell & Co., at 20s. per share. The firm is to be paid a commission of 1½ per cent., £30,000, for so doing. The G.E.C. will therefore receive about 19s. 8½d. per share from the bankers, for shares which the company's own shareholders would have been glad to subscribe for at 20s. The General Electric's 7½ per cent. preference shares stand at 37s. and the 6¼ per cent. preference at 33s., giving an average yield of 4 per cent. on the money. This implies that the new 4¼ per cents. will probably stand upon a 4 per cent. basis of yield, making the price about 21s.

High Prices : Low Yields

The extent to which confidence is felt in the post-war prospects of industrial companies receives practical illustration from the manner in which prices of the ordinary shares in such companies have advanced to levels at which the return is meagre. British Insulated, Callender's, General Electric, and Associated Electrical Industries yield, for example, less than 3½ per cent.; Henley's return £3 15s. Crompton Parkinsons pay less than 3¼ per cent. Ordinary shares such as English Electric return about 3½ per cent. Consolidated Signals, Crabtrees and Brush pay slightly over 4 per cent. The list could be considerably extended but these examples indicate the optimism which surrounds the post-war outlook for this branch of industry.

Edmundsons

Edmundsons Electricity Corporation has declared an interim dividend of 2½ per cent. on its ordinary shares, repeating the rate regularly paid since 1939. In each of the years since then, the final has been 3½ per cent., making 6 per cent. for the year, which ends with March 31st. It was in 1938 that

(*Continued on page* 834)

ELECTRICAL INVESTMENTS

Prices, Dividends and Yields

Company	Dividend Previous	Dividend Last	Middle Price Dec. 5	Rise or Fall	Yield p.c. £	s.	d.
Home Electricity Ordinary							
Bournemouth and Poole	12½	12½	62/6	..	4	0	0
British Power and Light	7	7	33/–	..	4	4	10
City of London ..	7	5½	30/–	..	3	13	4
Clyde Valley ..	8	8	42/–	..	3	16	0
County of London	8	8	43/–	..	3	14	5
Edmundsons ..	6	6	31/–	..	3	17	5
Elec.Dis.Yorkshire	9	9	45/6	..	3	19	6
Elec. Fin. and Securities ..	12½	13½	60/6	..	4	9	0
Elec. Supply Corporation ..	10	10	50/6	+6d.	3	18	6
Lancs. Light and Power ..	7½	7½	37/–	..	4	1	1
Llanelly Elec. ..	6	6	26/6	..	4	10	7
Lond.Assoc.Electric	3	4	26/–	..	3	1	6
London Electric	6	6	30/6	..	3	18	8
Metropolitan E.S.	8	8	43/–	..	3	14	5
Midland Counties	8	8	41/6	..	3	17	0
Mid. Elec. Power	9	9	44/–	..	4	1	10
Newcastle Elec.	7	7	32/–	..	4	7	6
North Eastern Elec.	7	7	34/6	..	4	1	2
Northampton ..	10	10	50/–	..	4	0	0
Northmet Power	7	7	41/–	..	3	8	4
Richmond Elec.	6	6	26/–	..	4	12	4
Scottish Power ..	8	8	40/6	..	3	19	0
Southern Areas	5	5	23/–	..	4	7	0
South London ..	7	7	30/–	..	4	13	4
West Devon ..	5	5	24/–	..	4	3	4
West Glos. ..	4½	3½	25/–	..	2	16	0
Yorkshire Elec...	8	8	43/–	..	3	14	5
Public Boards							
Central Electricity :							
1955–75 ..	5	5	115	..	4	7	0
1951–73 ..	4½	4½	106xd	..	4	5	0
1963–93 ..	3½	3½	104	..	3	7	4
1974–94 ..	3½	3½	100½	..	3	4	8
London Elec.Trans.	2½	2½	98½	..	2	10	9
London & Home Counties 1955–75	4½	4½	112	..	4	0	4
Lond.Pass.Trans.Bd.							
A	4½	4½	121½xd	..	3	14	1
B	5	5	122½xd	+1½	4	1	8
C	3	3½	69	+1	4	14	2
West Midlands J.E.A. 1948–68	5	5	106½	..	4	14	0
Overseas Electricity Companies							
Atlas Elec. ..	Nil	Nil	7/3	..		—	
Calcutta Elec. ..	6*	6*	46/6	+6d.	2	11	9
Cawnpore Elec...	10	7	41/3	+1/–	3	7	9
East African Power	7	7	35/–xd	+6d.	4	0	0
Jerusalem Elec. ..	7	5	29/–	..	3	9	0
Kalgoorlie (10/–)	5	5	10/6	..	4	15	3
Madras Elec. ..	Nil	4	32/6	..	2	9	4
Montreal Power	1½	1½	22½	–½		—	
Nigerian Elec. ..	8	10	35/–	..	5	14	5
PalestineElec."A"	5*	5*	39/–	..	2	11	3
Perak Hydro-elec.	6	7	13/–	–6d.		—	
Tokyo Elec. 6%	6	6	26	–2		—	
VictoriaFallsPower	15	15	80/6	+¼	3	8	7
WhitehallInv.Pref.	—	6	26/–	..	4	12	4

Company	Dividend Previous	Dividend Last	Middle Price Dec. 5	Rise or Fall	Yield p.c. £	s.	d.
Equipment and Manufacturing							
Aron Elec. Ord.	15	15	61/–	..	4	18	4
Assoc. Brit. Eng.	6	7	57/6	..	2	8	9
Assoc. Elec. :							
Ord.	10	10	57/–	..	3	10	5
Pref. ..	8	8	39/6	..	4	1	0
AutomaticTel.&El.	12½	12½	67/–	..	3	14	7
Babcock & Wilcox	11	11	53/–	..	4	3	0
British Aluminium	10	10	46/–	..	4	7	0
British Insul. Ord.	20	20	5⅛	+1/32	3	10	0
British Thermostat (5/–)	18½	18½	20/–	..	4	12	6
British Vac. Cleaner (5/–)	30	30	32/6	..	4	12	3
Brush Ord. (5/–)	8	9	11/–	..	4	1	9
Burco (5/–) ..	15	15	16/–xd	–9d.	4	13	9
Callender's ..	15	20	5⅛	+¼	3	11	5
ChlorideElec.Storage	15	15	85/–xd	+6d.	3	10	7
Christy Bros. ..	12½	17½	77/6	..	4	10	4
Cole, E. K. (5/–)	10	15	34/6	..	2	3	6
Consolidated Signal	24	27½	6¾	..	4	1	6
Cossor, A. C. (5/–)	7½*	10*	24/–	–6d.	2	1	8
Crabtree (10/–) ..	17½	17½	43/–	+1/6	4	1	4
Crompton Parkinson Ord. (5/–) ..	20	22½	33/6	..	3	7	3
De La Rue ..	35	40	9½	–¼	4	2	8
E.M.I. (10/–) ..	6	8	36/3	..	2	4	1
Elec. Construction	10	12½	58/9	+1/9	4	5	0
Enfield Cable Ord.	12½	12½	64/–	..	3	18	4
English Electric	10	10	55/–	+1/6	3	12	8
Ensign Lamps (5/–)	25	15	21/3	..	3	10	8
Ericsson Tel. (5/–)	22*	20*	53/9	..	1	17	8
Ever Ready (5/–)	40	40	42/–	..	4	15	3
Falk Stadelmann	7½	7½	34/6	..	4	7	0
Ferranti Pref. ..	7	7	31/3	..	4	9	7
G.E.C. :							
Pref.	6½	6½	33/3xd	+6d.	3	18	4
Ord.	17½	17½	97/–	+1/–	3	12	2
General Cable (5/–)	15	15	16/–	+1/–	4	13	9
Greenwood&Batley	15	15	16/9	..	6	8	0
HallTelephone(10/-)	12½	12½	31/6	..	3	19	4
Henley's (5/–) ..	20	20	2¢/9	+3d.	3	15	0
4½% Pref. ..	4½	4½	24/–	..	3	15	0
Hopkinsons ..	15	17½	71/9	..	4	17	9
India Rubber Pref.	5½	5½	23/–	..	4	15	9
Intl. Combustion	30	30	6½	..	4	12	4
Johnson & Phillips	15	15	74/–	..	4	1	1
Lancashire Dynamo	22½	22½	100/–	..	4	10	0
Laurence, Scott(5/–)	12½	12½	13/3	..	4	14	2
London Elec. Wire	7½	7½	38/–	..	3	19	0
Mather & Platt ..	10	10	56/3	..	3	11	2
Metal Industries (B)	8	8½	50/–	–6d.	3	8	0
Met.Elec.CablePref.	5½	5½	21/3	..	5	3	6
Mid. Elec. Mfg. ..	25	25	7½	..	3	10	3
Murex	20	20	5	–1/8	4	0	0
Newman Ind. (2/–)	20	20	7/3xd	..	5	10	0
Philco (2/–) ..	—	—	14/6	–6d.		—	
Power Securities	6	6	29/–	..	4	2	9
Pye Deferred (5/–)	25	25	32/6	..	3	17	0
Ransome & Marles	20	20	87/6	..	4	11	4
Revo (10/–) ..	17½	17½	44/–	+1/–	3	19	7
Reyrolle ..	12½	12½	71/3	..	3	10	3

(*Continued on next page*)

* Dividends are paid free of Income Tax.

Company	Dividend Previous	Dividend Last	Middle Price Dec. 5	Rise or Fall	Yield £ s. d.
Equipment and Manufacturing (*Continued*)					
Siemens Ord. ..	7½	7½	36/3	..	4 2 9
Strand Elec. (5/–)	10	12½	12/–	..	5 4 2
Switchgear & Cowans (5/–) ..	20	20	20/9	+1/3	4 16 7
T.C.C. (10/–) ..	5	7½	23/9	..	3 3 2
T.C. & M. ..	10	10	56/–	..	3 11 6
TelephoneMfg.(5/–)	9	9	12/–xd	..	3 15 0
Thorn Elec. (5/–)	20	20	28/9	+3d.	3 9 6
Tube Investments	20	22½	5⅛	+⅛	4 8 9
Vactric (5/–) ..	Nil	22½	17/6	..	6 8 6
Veritys (5/–) ..	7½	7½	8/3	..	4 11 0
WalsallConduits(4/–)	55	55	52/6	+6d.	4 3 10
Ward & Goldstone (5/–)	20	20	30/6	..	3 5 8
WestinghouseBrake	12½	14	75/–	..	3 14 8
West, Allen (5/–)	7½	7½	8/9	..	4 5 9
Traction and Transport					
Anglo-Arg. Trans :					
First Pref. (£5)	Nil	Nil	2/6	..	—
4% Inc. ..	Nil	Nil	8	..	—
Brit. Elec. Traction :					
Def. Ord. ..	45	45	1200	–5	3 15 0
Pref. Ord. ..	8	8	190	..	4 4 3
Bristol Trams ..	10	10	57/–	..	3 10 2
Brazil Traction ..	1¾	2	26¾	..	7 9 7
Calcutta Trams	6½	7½	72/6	–½	2 1 5
Cape Elec. Trams	5	6	26/–	..	4 12 4
Lancs. Transport	10	10	47/6	..	4 4 3
Southern Rly. :					
5% Prefd. ..	5	5	78	+1	6 8 2
5% Pref. ..	5	5	120½	+1	4 3 0
T. Tilling ..	10	10	62/–	..	3 4 6
West Riding ..	10	10	47/6	..	4 4 2
Telegraph and Telephone					
Anglo-Am. Tel. :					
Pref. ..	6	6	123	..	4 17 7
Def.	1½	1½	30	..	5 0 0
Anglo-Portuguese	8	8	28/–	+6d.	5 14 6
Cable & Wireless :					
5½% Pref. ..	5½	5½	116½	..	4 14 5
Ord.	4	4	83½	+½	4 16 5
CanadianMarconi$1	Nil	4cts.	9/–	..	—
Globe Tel. & Tel. :					
Ord.	8¼*	5*	39/6	..	2 10 8
Pref. ..	6	6	31/–	..	3 17 5
Great Northern Tel. (£10)	Nil	Nil	29	+1	—
Inter Tel. & Tel.	Nil	Nil	19	..	—
Marconi-Marine ..	7½	7½	36/6	..	4 2 4
Oriental Tel. Ord.	16	10	49/6	..	—
Telephone Props.	Nil	6	21/3	..	5 13 0
Tele. Rentals (5/–)	10	10	12/3	..	4 1 8

* Dividends are paid free of Income Tax.

Stocks and Shares (*Continued from page* 832)

the capital was increased 50 per cent. by a bonus issue. In those days, the dividend was 9 per cent., so that the succeeding 6 per cent. was at relatively the same rate. The company controls, or is financially interested in, electricity supply undertakings which are owned by associated companies. In addition to this, it carries on business as electrical engineers and contractors. The authorised capital is £11¼ million, of which rather over £8¼ million has been issued. Of the latter, £6¾ million is in ordinary stock of £1 units, quoted at 31s., to give a yield of £3 17s. 5d. per cent. The company's shares rank as a first class investment in this group.

Lesser-Known Shares

Inquiries arise every now and then for the prices of the lesser-known preference shares dealt in by the Home electricity supply market, and it may be of service to set out a few of those to which public attention is occasionally directed. The quotations rarely appear in the Press, owing to lack of general business in them. Taking half a dozen examples, the appended table gives the present prices, with the yields. How seldom some of the shares are dealt in, can be seen by reference to Northampton Electric Light & Power preference; the price is 23s. 9d., but shares have not changed hands in the Stock Exchange market since May, 1941. In Urban Electric preference the last recorded transaction was in December, 1942. Others in the following list have come to market comparatively recently.

Preference	*Div.*	*Price* s. d.	*Yield* £ s. d.
Egham & Staines	7½	32 6	4 12 4
Isle of Wight	5	95 0	5 5 3
Lincolnshire & Central ..	4½	21 0	4 3 9
Northampton Electric ..	5	23 9	4 4 3
St. Austell & District ..	7	26 3	5 6 8
Urban Electric	6	28 9	4 3 6

The Isle of Wight shares are of £5 each; the rest are £1 shares.

Indian Shares

Violent fluctuations in the price of Calcutta Tramway ordinary shares have been one of the Stock Exchange features during the past week. From 77s. 6d. the price fell away to 67s. 6d., upon a statement that the Government of Bengal had declined to allow the Calcutta Corporation to acquire the tramway undertaking. The Government of Bengal justified its refusal by the statement that such a transaction would invoive the raising of a loan by the Corporation. The price fell 7s. 6d. in a day. The Calcutta Corporation promptly announced that Government sanction was not necessary, and there at the time of writing the matter rests. On balance the shares show a recovery of half-a-crown at 72s. 6d. Calcutta Electric Supply at 46s. 6d. and Cawnpore Electrics at 2⅛ are respectively 6d. and 1s. better. Madras Electrics retain, at 32s. 6d., their last week's rise of 2s. 6d.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (1s. each) may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2.

R. N. ARNOLD and Metropolitan-Vickers Electrical Co., Ltd.—"Apparatus for testing the balance of rotors." 5990. April 14th, 1943. (565606.)

Automatic Telephone & Electric Co., Ltd., C. Gillings and C. E. Beale.—"Telephone or like systems." 7770. May 15th, 1943. (565639.)

Babcock & Wilcox, Ltd.—"Return bends of tubulous heat-exchangers formed with openings closed by pressure-tight closure devices." 7551/43. July 11th, 1942. (565585.)

British Thomson-Houston Co., Ltd.—"Electric valve systems for energising a load circuit through a capacitance and transformer." 2794/43. February 28th, 1942. (565602.) "Apparatus for starting and controlling electric discharge devices." 5921/43. April 21st, 1942. (565604.) "Lamp sockets." 7245/43. May 8th, 1942. (565608.)

A. C. Cossor, Ltd., D. A. Bell and H. Moss.—"Cathode-ray tubes." 7024. May 4th, 1943. (565547.)

Dubilier Condenser Co., Ltd. (W. Dubilier).—"High-voltage terminals for electrical apparatus." 6793. April 29th, 1943. (565521.)

Duratube & Wire, Ltd., and J. Veit.—"Extrusion apparatus for thermoplastic material." 2703. February 18th, 1943. (565601.)

Electric Transmission, Ltd., and E. C. Gumbrell.—"Operating mechanism for combined air-break power switch and earth switch." May 10th, 1943. (565553.)

Electro Metallurgical Co.—"Manufacture of cast iron." 1438/43. September 30th, 1941. (565598.)

W. T. Henley's Telegraph Works Co., Ltd., W. T. Macdonald and P. R. Stevens.—"Insulated electric conductors." 10178. June 24th, 1943. (565619.)

International Combustion, Ltd., and J. W. Wray.—"Travelling grates." 9822. June 18th, 1943. (565618.)

Johnson & Phillips, Ltd., and J. T. Sanders.—"Electric water heaters for domestic purposes." 4271. March 16th, 1943. (565505.) "Electric water heaters." 4270. March 16th, 1943. (565603.)

W. MacKirdy.—"Power plant for aircraft." 17226. December 3rd, 1942. (565531.) "Power plant for aircraft." 16260/44. December 3rd, 1942. (Divided out of 565531.) (565560.)

M. & C. Switchgear, Ltd., and S. Pfob.—"Push-operated electric switches." 7596. May 12th, 1943. (565555.)

Marconi's Wireless Telegraph Co., Ltd.—"Cathode sleeves and indirectly heated cathodes including such sleeves." 1841/43. January 1st, 1942. (565578.)

P. H. Morrison and Plessey Co., Ltd.—"Linear electric switches." 7192. May 6th, 1943. (565524.)

Partridge, Wilson & Co., Ltd., and F. A. Loach.—"Automatic contactors or switches of the change-over and simple on-off types." 8921. June 3rd, 1943. (565614.)

L. F. Reeve.—"Pneumatically-operated pick-up unit for use in electric organs and the like." 5880. April 13th, 1943. (565546.)

Standard Telephones & Cables, Ltd., and E. O. Willoughby.—"Adjustable aerials." 7329. May 8th, 1943. (565526.)

Standard Telephones & Cables, Ltd., P. K. Chatterjea and C. T. Scully.—"Thermionic valve circuits." 7710. May 14th, 1943. (565609.)

Standard Telephones & Cables, Ltd., L. W. Houghton and D. M. Ambrose.—"Frequency dividing arrangements." 7602. May 12th, 1943. (565638.)

Syncro Machine Co.—"Drawing wire." 7385/43. March 13th, 1942. (565554.)

J. H. Watson and H. E. Anderson.—"Paper insulation of electrical conductors." 9650. June 16th, 1943. (565617.)

Western Electric Co., Inc.—"Shock-absorbing mountings for electrical apparatus." 6389/43. April 21st, 1943. (565519.) "Anti-vibration mechanical coupling for rotary power transmission systems." 6856/43. May 28th, 1942. (565522.)

Amended Specification

558143. Philips Lamps, Ltd.—"Velocity modulated electron discharge tubes."

TRADE MARK APPLICATIONS

THE following applications for British trade marks have been made. Objections may be entered within a month from November 29th:—

ELGA (design). No. B628,509, Class 7. Electric welding machines and parts thereof not included in other classes.—Aktiebolaget El- & Gassvetsning, Frigangen, Gothenburg. Address for service: c/o Edwin C. Axe, 27, Chancery Lane, London, W.C.2.

WHITE CROSS. No. 630,676, Class 9. Electric coffee percolators or brewers.—S.L.R. Electric, Ltd., 58-9, South Harrow Viaduct, South Harrow.

INFORMATION DEPARTMENT

GENERAL inquiries from readers relating to sources of electrical goods, makers' addresses, etc., are replied to by our Information Department through the post. Inquiries should be accompanied by a stamped addressed envelope.

Our extensive records enable us to reply to most queries, but occasionally we ask for our readers' assistance in tracing names and adresses not known to us. We should be glad to have such information regarding the following:—

Suppliers of machinery for vitriting lamp caps.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Australia. — VICTORIA. — April 26th. Melbourne City Council. Supply and erection of electrostatic flue gas dust collecting equipment. Specification from City Electrical Engineer's Office (£1 1s.).

Eye.—December 18th. Borough Council. Supply and installation of a centrifugal borehole pump and vertical spindle electric motor with automatic control equipment. Lt.-Col. W. Herbert Bateman, consulting engineer, Batheaston, Bath (deposit, £1 1s.).

Fife.—December 13th. County Council Catering Committee. Work (including electrical) in connection with central kitchen at Muiredge, near Buckhaven. Schedules (£1 1s.) from the surveyors, C. R. Douglas & Son, 15, East Port, Dunfermline.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Barnsley.—Nurses' home and maternity home; H. Taylor, borough surveyor, Town Hall.

Bolsover.—Houses, Moor Lane; S. Hoten, surveyor, Council Offices, Bolsover, near Chesterfield.

Brighouse.—Houses, Huddersfield Road, Daisy Road and Woodhouse Lane; trustees, Woodhouse Settled Estates.

Works additions, Brookfoot Lane; S. Marshall & Sons, Ltd., quarry owners, Southowram, Halifax.

Works additions, Lower Edge Lane; S. Gledhill & Sons, quarry owners, Rastrick.

Works additions; S. G. Whiteley & Co., blacksmiths, Ogden Lane, Rastrick.

Works extensions, Mission Street; Helliwell & Co., Ltd., Perfection Glazing Works.

Works extensions, Mill Lane; Wood, Robinson & Co., Ltd., silk spinners, Wilkin Royd Mills.

Bristol.—Additions, Ham Green Sanatorium; borough engineer, 7, College Fields, Clifton, Bristol.

Cheshire.—Home for the blind (in co-operation with county boroughs); E. M. Parkes, county architect, The Castle, Chester.

Colchester.—Community centre (£10,000); borough surveyor, Town Hall.

Essex.—Youth centre, Great Bardfield (£2,109) and school huts (£3,690); county architect, Chelmsford.

Glasgow.—Works reconstruction; Strathclyde Paint Co., Ltd.

Gosport.—Additions at Brockhurst Infants' School, and kitchen at Alverstoke School; borough surveyor, Town Hall.

Hampshire.—Additions, Alton and Andover Grammar Schools (£2,250) and maternity home, Basingstoke (£21,000); county architect, Winchester.

Hull.—Works extensions; Hall's Barton Ropery Co., Ltd., High Street.

Kilmarnock.—Building (£1,100) for Glenfield & Kennedy; manager.

Lancashire.—School, Garstang; county architect, County Offices, Fishergate Hill, Preston.

London.—BERMONDSEY.—Works additions, Raymouth Road; Skelton, Sleat & Co.

Macclesfield.—Theatre, Derby Street and Church Street; Whittaker & Bradburn, architects, 5, Jordangate, Macclesfield.

Newcastle-on-Tyne.—Reinstatement of Pendower School for the City Council; city estate and property surveyor, Town Hall.

Northampton.—Leather factory extension; Manfield & Sons, Ltd.

Northumberland.—Canteen, Hexham Lowgate School; H. Wallace & Son, builder, Hexham.

Canteen, Ingoe School; M. Hogarth & Son, builders, Corbridge.

Nottinghamshire.—Colony for mental defectives, Newark (£300,000); county architect, Shire Hall, Nottingham.

Portsmouth.—Junior technical college (£52,250), site of Hilsea College; F. J. Sparks, town clerk, Municipal Offices, Royal Beach Hotel, Southsea.

Salisbury.—Extension of maternity department at Salisbury Infirmary; A. Smart, town clerk, Council House, Bourne Hill, Salisbury.

Sevenoaks. — Extensions, Chiddingstone Causeway; John Wisden & Co., Ltd., Baltic Road, Tonbridge.

Spalding.—Nurses' home (£3,800), in grounds of Institution, for Holland C.C.; county architect, County Hall, Boston, Lincs.

Staffordshire.—Central kitchen and canteen, Baddeley Green, Leek; C. M. Coombs, county architect, County Buildings, Stafford.

West Sussex.—Junior technical school for building (£5,385), Worthing; county architect, County Hall, Chichester.

Wigan.—Central kitchen, Poolstock; L. Lyons, borough engineer, Municipal Buildings, Library Street.

Wolverhampton.—Schools on Willenhall Road and Bushbury estates; W. M. Law, borough engineer, Town Hall.

Edinburgh Illuminating Engineers

AT a meeting of the newly formed Edinburgh group of the Illuminating Engineering Society at Heriot-Watt College, Mr. A. L. Randall spoke on "Fluorescent Tubes and their Applications." The next meeting of the Society will be held on December 15th, at Edinburgh University Physics Department, when Dr. C. Bernard Childs will speak on "Light and Colour."

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